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THE HATTERAS LIGHTHOUSE CAISSON is completed at Norfolk, Va., and a false bottom has been put in place, and preparations are being made to tow it down the coast to the Diamond Shoal. It is 50 ft. in diameter and 40 ft. high.

THE BATES PROCESS, for converting malleable iron castings into steel, is to be put into operation in Atlanta. The works will be commenced about July 1, says a report from that place, and the necessary capital is assured. The claim is made that by this process the best quality of tool-steel can be produced for 8 to 10 cts. per pound. Mr. EDWARD VAN WINKLE is the president of the company.

PROPERTY FOR THE EAST RIVER BRIDGE TERMINAL, on the Brooklyn side, has already been secured to the value of $160,500, and an offer of $214,500 has been made for other property, for which the terms have not yet been accepted. The most valuable land under discussion is the Third M. E. Church, on Washington street, which is assessed at $40,000, and for which $104,000 has been offered.

THE LIGHTING AND VENTILATION OF THE FOURTH AVENUE TUNNEL, of the N. Y. C. R. R., is before the State Railroad Commissioners, and much advice, wise and otherwise, was given them at the meeting of last week. Electric lights, perforated water-pipes to lay the dust, exhaust pipes in the roof of the tunnel, etc., were suggested by various parties. The Commissioners have not yet given out their own views on this subject.

THE POLLUTION OF THE OHIO RIVER is being investigated by the State Board of Health. Dr. PROBST says that his report will be very unfavorable as to the use of Ohio river water for drinking purposes. An interstate agreement would be necessary to prevent further pollution.

A PROFIT SHARING RAILWAY SCHEME is being discussed by the directors of the Cairo Short Line, St. Louis, Alton & Terre Haute R. R. The theory is to interest officers and employees in the economic management of the road and ownership of the property. A dividend paying stock is proposed which would be held by employees mainly, and all surplus, after compensating labor and capital, would be divided among the employees of a certain length of service, in proportion to their salaries. The last annual statement of this railway showed a surplus of $1,050.74, on a total of receipts of $617,047.50.

THE BROOKLYN BRIDGE TERMINALS are provided for by the amount of $250,000 voted last week by the New York Board of Estimates. The act of 1891 provided for these terminals, authorizes the expenditure of $1,500,000, two-thirds of this to be paid by Brooklyn, and the other third by New York. One-half of each city's quota was called for at a meeting of the bridge trustees on May 11, and New York has answered as above. This amount is raised on bonds that are to fall due in less than 30 years and they are to draw not more than 3 per cent. interest.

THE PIKE'S PEAK RAILWAY COMPANY commenced running trains up the rack-rail road to the half-way house on June 4. There is considerable snow on the summit and it is thought that the full trip by rail will not be made much before July. Passengers can now go to the summit by a saddle-train from the half-way house. The road has been put in thorough order, and a test train of two cars, loaded with iron and weighing in all 32 tons, has been sent up. Mr. WILLIAM HILDENBRANDT, the engineer of the Abt system in America, is now at Manitou Springs superintending the tests and general operation.

THE MOST SERIOUS RAILWAY ACCIDENT of the week was a bad collision, June 8, on the Missouri, Kansas & Texas Ry., between Savannah and Frink, Kan. Two freight trains had been ordered to pass at Frink. When the first train reached the station the engine driver saw a train on the side track, and supposing that it was the one he was to pass he did not stop for orders, with the result that he met the other train further down the line. Both engines were wrecked and 30 freight cars were burned. Three men were killed and their bodies burned in the wreck, and six were seriously injured. One of the axles of an engine on the Pittsburg, Fort Wayne & Chicago R. R. broke June 6 while the engine was hauling a passenger train near Pittsburg, Pa. The connecting rod on one side was broken, but the engine did not leave the rails. A pasenger train on the Chicago, St. Paul & Kansas City was derailed near Valeria, Ia., June 4, but crossed a bridge in safety before the train was stopped, the locomotive keeping on the rails.

A RAILWAY BRIDGE at Vernon, Tex., over the Pease River, was washed away June 4.

THE FLOOD in the Colorado River on June 6 washed away the cofferdam and flooded the excavation for the foundation of the dam to be built across the river at Austin, Tex. The dam is being constructed by means of a suspension cable way, 1,350 ft. span, with a 2½-in. cable, which was furnished by the Lidgerwood Mfg. Co., of New York. B. Corrigan is the contractor. During the heavy rain storm of 48 hours duration, which prevailed west of the city, the river is said to have risen 5 ft. in 5 minutes and 12 ft. in 3 hours, while on June 7 it was 25 ft. above low-water mark in the mountain gorge above the city.

A BREAK IN A RESERVOIR EMBANKMENT AT DALLAS, TEX., occurred recently; a large part of the southwest bank of one of the new Turtle Creek reservoirs sinking vertically. The reservoirs are near the Trinity River, and it is thought that the sinking of the bank was caused by quicksand beneath or possibly by the action of the river. The embankments are of clay, without heartwall, the outer part containing some black earth. They are 12 ft. wide on top and have an inner slope of 2 to 1, faced with 4 ins. of brick on edge in cement, with 3 ins. of gravel beneath. The settlement of the bank was over 300 ft. in length and extended from the toe of the outer slope to within 5 ft. of the top of the inner slope. The brick and cement lining was cracked in an almost straight line at 11 ft. from the top, and from this line to the top of the embankment there was a slight settlement. The information relating to the accident is from the *Dallas News*. A plan of the reservoirs is given in the Manual of American Water-Works for 1889-90, p. 574. Mr. J. D. COOK, Toledo, O., was Designing Engineer, and Mr. N. WERENSKIOLD, Engineer in Charge of Construction.

THE GREENLAND EXPEDITION of Mr. ROBERT E. PEARY, Civil Engineer, U. S. N., started from New York on June 6, on the steam brigantine Kite, of 280 gross tons. With Mr. PEARY are his wife and five associates that he does not wish to name. Prof. ANGELO HEILPRIN, geologist, is to lead the auxiliary West Greenland expedition; Profs. BENJAMIN SHARP and G. F. HALT are the zoölogists Dr. W. E. HUGHES, ornithologist; Dr. W. H. BURK, botanist; L. W. MENGEL, entomologist; FRAZER ASHURST and Dr. ROBERT N. KEELEY, surgeon, and ALEXANDER C. KENNEALY, journalist. The Kite will sail for Whale Sound, where a house will be built for Mr. and Mrs. PEARY, and then a start will be made in establishing provision stations to the northward and eastward, an operation which will consume about one year. The actual exploration party will not set out until the summer of 1892, when two parties will be dispatched, and the northward journey made with sleds, and on skies, or snow-shoes. Mr. PEARY believes that his party will reach a point within 350 miles of the North Pole by traveling 1,200 miles through the interior from and to the main station in about 3 months. The daily journey will cover about 18 or 20 miles. The West Greenland party will keep as near as possible to the west coast.

A GREENLAND EXPLORING EXPEDITION started from Copenhagen on last Sunday, one day later than that of Mr. PEARY from New York. The second expedition is sent out by the Danish government, and is under the command of Lieutenant RYDER. Its purpose is to explore the unknown east coast between 66° and 70° north latitude, and to connect the surveys of SCORESBY and the KALDEWEY expedition on the north with the discoveries of Captain HOLM on the south. This would complete the outline of the east coast of Greenland from Cape Farewell to Cape Bismarck, in the far north.

THE DYNAMITE-THROWER *Vesuvius* is to have another trial, and the board appointed to conduct these trials recommends as follows: That suitable sights be added and some changes be made in the auxiliary firing-valves; that the guns be accurately ranged at Annapolis over a measured course; that the FISK range-finder be supplied to the ship, and that the firing-valves be arranged so that they can be operated either from the fighting-tower or from the gun-room, in case the former is disabled.

TEN-WHEEL PASSENGER AND FREIGHT LOCOMOTIVES, and six-wheel switch engines are being built for the Cleveland, Cincinnati, Chicago & St. Louis Ry., and the contract has been awarded by Mr. J A. BARNARD, Assistant General Manager, to the Brooks Locomotive Works, Dunkirk, N. Y. The dimensions and other particulars of these engines are as follows, the weights being for the engine loaded, with 3 gages of water, and for the tender loaded with coal and water.

	Passenger.	Freight.	Switching.
Type of engine	Ten-wheel	Ten-wheel.	Six-wheel.
Cylinders, ins	18½×24	19×24	18×24
Diam. of driving wheels, ins.	66	56	50
" of truck wheels, ins.	30	28	.....
" of boiler, ins.	60	60	58
Form of boiler	Wagon top	Wagon-top.	Straight.
Boiler pressure, lbs.	160	160	160
Firebox, inside of sheets, ins.	77⅞×33⅞	77⅞×33⅞	83⅞×31⅞
Tubes, No.	273	273	208
" diam., ins.	2	2	2
" length, ft. ins.	13.4⅛	13.4⅛	11.1½
Heat. surface: tubes, sq. ft.	1,890.38	1,890.38	1,195.34
" firebox, "	156.28	156.28	120.70
" total, "	2,046.66	2,046.66	1,316.04
Grate area, "	18.16	18.16	18.41
Wheel base, driving, ft. ins.	15.6	15.6	11 0
" total, "	25.8	25.8	11.0
Weight on driv. wheels, lbs.	105,000	105,000	96,000
" truck, "	27,000	26,000	.....
" total, "	132,000	131,000	96,000
Tank, U. S., galls.	3,700	3,700	2,700
Coal space, tons	8	8	6
Diam. tender truck whls., ins.	33	33	33
Weight of tender, lbs.	66,000	66,000	57,000
Brake	Westinghouse.	New York	New York

THE SOUTH PASS JETTIES, according to the last report of Major QUINN, U. S. Engineer Corps, shows a 26-ft. channel 50 ft. wide beyond the sea ends of the jetties. Turning to the eastward of this direct channel, however, there is another with a depth of 26 ft. for a width of 400 ft. and 30 ft. for a width of 120 ft. At the head of the South Pass there is a 29.3-ft. channel, and the 23-ft. channel is very wide. In Goat Island Reach the 26 ft. channel is 310 ft. wide. In Grand Bayou Reach the 26-ft. channel is 400 ft. wide.

THE NEW YORK AND NEW JERSEY BRIDGE CO. having for its object the bridging of the Hudson River, was organized on June 8 by a meeting in Jersey City of the commissioners appointed by the State of New Jersey. Books will be opened for subscriptions on July 20. Until the cash is subscribed, however, there will be no consolidation with the New York Bridge Co., though the promoters confidently predict this event in the near future.

Notes on the Nicaragua Canal.

(*Continued from page 536.*)

The distance from the west end of the Divide to the San Juan River, near the Ochoa dam, is 12.5 miles; and on this line the canal is really a continuous lake of varying but very liberal width. But the hills bounding the San Francisco and Machado basins, which these lakes will cover, are by no means unbroken at the elevation of 110 ft. above the sea, the assumed maximum level of Lake Nicaragua and this long summit level of the completed "canal." Eight larger gaps will have to be closed by embankments, aggregating 2,440 ft. in length on the valley floor and 12,280 on the crest, with a maximum height of dam of 60 ft. And besides these, 59 smaller openings will require embankments aggregating 18,280 ft. in length on the crest line (6 ft. above water level), and varying in height from 1 ft. to 50 ft. East of the Divide, and shutting off the Deseado Valley, will be another heavy embankment, 70 ft. high and 1,050 ft. long, and a number of smaller banks aggregating 5,800 ft. in length on the crest, and varying in height up to 20 ft.

Camp Perez; Engineers Quarters on Line of Nicaragua Canal.

This view shows the general character of the larger trees in the country east of Lake Nicaragua. Considerable clearing has been done at this point.

The amount of material required for filling these gaps will be seen in the estimate of quantities for the various sections of the canal, to be given later. But it is proper at this point to say something about this very important part of the engineering work, and to include in this description the Ochoa dam, across the San Juan River, the most important of all.

While we did not follow the entire trail bordering the southern flowline of the San Francisco valley or basin, the many ravines we did cross were similar in their general conformation to the gaps which have to be filled up in the confining ridge. These ravines are usually steep, and the material in the hills is generally a stiff clay with occasional outcroppings of the indurated clay rock before described. It is the intention of the engineers to close these gaps with rockfill dams, backed with earth. Wherever the conformation permits it, waste-weirs will be made in the solid earth of the crest, and protected by rock or concrete paving. In other places where it is necessary to waste the water over weirs in the dams, these will be made with a very flat outer slope and paved with large stones; and as the length of waste weir provided is great, the maximum depth on the crest, with the greatest floods possible, will not exceed 15 ins. These weirs will be 5 ft. lower than the crest of the remainder of the confining embankment, and their discharging capacity in this basin alone is figured at over 90,000 cu. ft. per second before the water raises to the top of the embankment proper. These figures would suppose an extraordinary freshet in the San Juan River; and it should be remembered that some of this flood water would also empty to the East, through the Divide cut and over the weirs in the Deseado Valley, or through the first lock to the east if necessary.

The method proposed for building these dams is one which mainly demands adequate transportation facilities for carrying to the dams the rock extracted from the Divide cut. It is for this purpose that the railway is located on the line of this crest, as before mentioned. Their strength lies in the amount of the rock piled into the gaps, and their cost is practically measured by the means provided for economically moving and handling the large mass of material needed but available. In the beds of some of these lateral streams there is a considerable depth of more or less soft mud; and these will doubtless require some special precautions. But even here, again, it is mainly a question of piling in rock until the soft material is broken through and the dam is founded on ground hard enough to carry it.

Since our previous descriptive articles on the Nicaragua Canal (Sept. 14, 1889) an important change has been made by relocating the Ochoa dam about 2 miles further down the San Juan River, or about 67 miles from Lake Nicaragua. By this change in the location the alinement of the canal, near the old dam site, is much improved by substituting one gentle curve for a reverse of three curves, and the entrance into the San Juan River is made correspondingly easier.

The later surveys, by which this new dam was located, show steep, confining ridges on both banks, running close down to the water's edge. Some gaps will have to be filled, as on the older line; but the estimated cost of the dam is about the same, and the railway line required is somewhat shorter to the new site. One decided advantage in the new dam, however, is that the surveys on the Costa Rica side of the river show a very favorable location for a long spillway, or weir, on solid ground, from which the water would be discharged into the Curaño Creek, which empties into the San Juan about 6 miles below the dam. There is an outcrop of rock on the site of the proposed weir, of as yet unknown extent; but the advantage of removing this spillway to a point remote from the Ochoa dam itself very much simplifies the problem at that point. The raising of the water by this dam would of course flood the lower valley of the San Carlos, the chief tributary of the San Juan from the south or Costa Rica shore above the dam. But as this river now carries much silt into the San Juan, the flooding of the valley would arrest much of this channel-obstructing material at or near the mouths of its various smaller tributaries and to a considerable extent prevent it from reaching the larger river and the line of the canal. The long waste weir mentioned would also divert a considerable part of this matter in suspension.

The San Juan River, at the new dam site, is about 1,000 ft. wide, and the water varies in depth from 8 ft. to 14 ft. The length of the dam on the crest line would be about 2,000 ft. and its average height above the river bottom about 60 ft. We have no figures at hand for the exact dimensions, but the figures given are very close. As now planned, this dam will be made of rock taken from the divide cuts, transported to the site by the railway mentioned and placed in position by a system of trestles or wire-rope tramways. It will be made with flat slopes, with a bottom width of at least 500 ft.; the smaller refuse from the rock excavation and gravel placed on the up-river side and the silt from the upper river will be depended upon to make it tight in time. Very considerable leakage during construction will be rather an advantage than otherwise.

The plans already prepared show three rows of sheet piling extending through the dam from abutment to abutment, and a substantial concrete core wall carried from the ends of the sheet piling well into the abutment hills and above flood level. We understand that there is a very considerable depth of soft mud in the bed of the river at this point, and it seems to us that the safest plan of construction would be one depending on weight and volume of heavy rock filling and flat slopes, rather than upon sheet piling that would break the homogeneity of the embankment. The mud mentioned would make it necessary to commence dumping the heavy material at the extreme upper limit of the site of the dam and allow this filling, by its settlement into the softer material, to find its own road to the bottom of the mud as the dam advanced down stream or was undercut by the current passing over it. In this way a thoroughly safe foundation would in time be made for the dam proper, passing down like a rough toothing into the solid bottom soil. This is the plan of construction proposed by the engineers, as we understand it, and while its execution requires the maximum of material, this material is in abundance and will cost only the transportation and handling, and we have no doubt that a substantial and safe dam can be thus constructed; especially if the spillway is removed from the dam, as now proposed.

This Ochoa dam will practically raise the water to the present level of Lake Nicaragua, and will afford a navigable channel up the San Juan River, varying in depth from 28 to 130 ft. and nowhere less than 1,000 ft. wide. To obtain this 28 ft., however, rock blasting, under water, and dredging to an average depth of 4½ ft. will have to be resorted to for a length of about 24 miles, nearest to the lake. The bulk of this rock work will be done at the Toro Rapids.

It should be mentioned here that,as the Ochoa dam would raise the present level of the water about the San Carlos River and flood the valley of that stream back to the confining ridge, lying to the east of that river, a number of embankments will also be required to fill gaps, more or less deep, in this confining ridge. These embankments would be constructed entirely of clay, with a top width of 15 ft. and slopes of 3 to 1 on both sides.

In Lake Nicaragua itself about 14 miles of dredging in soft mud will be required, to an average depth of nearly 10 ft., to obtain a 30 ft. channel. This dredged cut would have a bottom width of 150 ft. and side slopes of 3 to 1. From the west end of this cut across the lake and to within 1,400 ft. of the west shore of the lake there is now a depth of from 30 to 150 ft. At the west shore, where the canal leaves the lake to pass to the Pacific, the entrance for the 1,400 ft. mentioned, will probably have to be made through rock, and is so estimated. Two cribpiers, or breakwaters, will also be required to counteract the effect of the prevailing winds in bringing sediment to the excavated channel.

As showing the value of Lake Nicaragua as a storage basin on the summit level of a ship canal with locks, it can be stated that this lake is 110 miles long by 46 miles wide in its extreme dimensions, and has a surface area of 2,600 sq. miles and a watershed of 8,000 sq. miles. The observed minimum flow at the San Juan outlet is 11,300 cu. ft. per second, and the maximum in the rainy season, as given by Col. CHILDS, is 18,059 cu. ft. Taking the mean flow at 14,724 cu. ft. per second, and assuming that 32 lockages in 24 hours require 127,400,000 cu. ft. of water, it will be seen that the lake alone discharges about ten times the quantity of water required for this extreme service in the canal.

But to this lake supply must be added the water from the various tributaries of the San Juan down to the Ochoa dam. The currents in this lake are weak; but under the influence of the northeast trade winds the water is often rough and choppy. These wind currents are at times intermittent; and as they have a tendency to pile the water on the south shore of the lake, the water rises with them slightly in the morning and falls with the wind in the evening; a phenomenon that accounts for the old-time belief that there was a tide in this inland sea. There are no tides, but there are fierce sharks in this elevated fresh-water lake; perhaps the only place in the world where they exist out of their proper element. The local report is that about 25 lives are sacrificed annually about Grenada to these ravenous monsters; and the natives fear them more than they do the alligators of the San Juan, of which we saw specimens at least 15 ft. in length in our passage up that river.

The narrow strip of territory separating Lake Nicaragua from the Pacific Ocean, on the route of the canal, is only 17 miles wide, and the highest intervening land is 42 ft. above the normal level of the lake, which is 110 ft. above sea level. This point is remarkable as being the lowest depression in the main ridge between the Atlantic and Pacific oceans on the American continent. This region differs from the divide on the Atlantic side in presenting hills of a gently rounding character; the forest growth is less dense, and much of the country is under cultivation. The divide cut again shows basaltic rock of a character well adapted for heavy masonry and jetty building. In the valley of the Rio Grande, which empties into the Pacific at the Brito end of the channel, and at other points, there is an abundance of excellent gravel and sand for concrete work. The rock showing plentifully along the banks of this stream is *tepetate*, however, or indurated clay, and is worthless for building purposes. The divide cut alone can be depended upon for useful massive rock. Lime of an excellent quality can be obtained in a number of places on the western division for work in which lime can be safely used; and the cathedral in Rivas and a number of other structures that have stood for many years attest the durable character of the masonry built with it. Useful timber is plentiful, and the cedar of this region, sometimes 4 ft. in diameter, is an excellent wood, much used in the better class of buildings.

West of Lake Nicaragua the canal is in excavation for 11.16 miles in length, in all. The summit cut is practically through an elevated plateau, with the land almost level, and at its highest point only 42 ft. above the normal level of the lake, and 152 ft. above mean tide in the Pacific Ocean. West of the lake a length of between 4 and 5 miles has been cleared of timber and undergrowth for a width of about 500 ft., and this work is now going on, including also the line of the railway location. The canal first follows the valley of the river Lajas for a distance of 8,260 ft., starting from the lake, and the cut, through rock and earth, will have a bottom width of 120 ft., with side slopes of 1½ to 1. The Lajas then turns to the south, and it is here proposed to divert it, and running south of the canal, to empty it into Lake Nicaragua a little south of its present mouth. The canal continues in a straight line; crosses the plain mentioned for a distance of about three-quarters of a mile, and at a distance of 4.7 miles from the lake reaches the summit, which lies in a depression about two miles wide. Beyond the divide the ground gradually descends with a slope of 9 ft. per mile until the canal line strikes the valley of the Rio Grande River, 1¼ miles beyond the divide. This river is very crooked and has steep banks of clay and *tepetate*, and for 1½ miles the canal line follows this valley but cuts across a number of sharp bends. About nine miles from the lake the canal enters the broad Tola basin, and continues across this basin for 5.5 miles, on the sailing line of the canal.

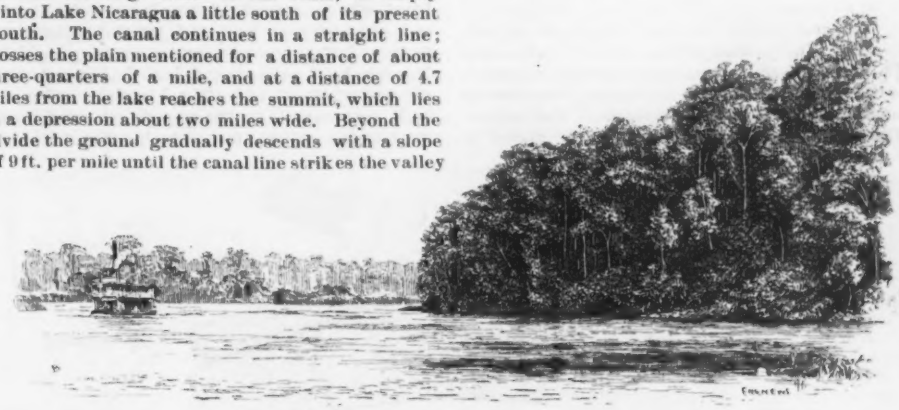
The Tola basin will have an area of 4,000 acres, an extreme width of 12,500 ft. and an average width of 5,500 ft. For a distance of over 4.5 miles it will carry a depth of from 30 to 70 ft. of water. The basin is formed by a dam 1,800 ft. long and 70 ft. high, abutting on two high hills at a place called La Flor. It will be made of rock obtained from the excavation for Locks 4 and 5, adjoining the west side of the dam, and in all respects will be similar in its construction to the dams at Ochoa and other points east of Lake Nicaragua. The level of water in this basin will be 110, or the same as that in Lake Nicaragua, which is thus practically extended to a point only 2.3 miles from the Pacific Ocean.

At the La Flor dam the two locks mentioned, with a lift of 42½ ft. each, lower the canal to a broad, flat section of country which slopes toward the Pacific at the rate of about 9 ft. per mile. The last lock, No. 6, is only 0.57 miles from the proposed Pacific terminus at Brito, and has a lift of 21 to 29 ft., according to the stage of the tide. From the commencement of the western divide cut to the east end of the Tola Basin, a distance of 7.4 miles, the bottom width of the proposed canal is 80 ft. and the depth is 30 ft. This cross-section has been criticised as being too narrow, but the Chief Engineer believes he is warranted in adopting it by observed experience in other ship canals; and the resulting saving in excavation is a very important item. With a ship of extreme beam and draft the safe speed would doubtless be very slow; but we do not fear the injury from contact with the rocky sides of the cut, which some prophesy, and expect in another issue to give some further matter relating to this section.

Brito, the future harbor on the Pacific coast, is now only a firm sandy beach, protected toward the west—for the coast line here runs nearly east and west—by a high rocky headland projecting a considerable distance beyond the mouth of the Rio Grande The broad valley of this river, in which the harbor is to be excavated, extends inland about 6,000 ft. nd the material of this valley is an alluvial deposit, showing no signs of rock whatever, and promising very easy dredging. It is covered near the sea by a mangrove forest of generally small trees; and further inland by heavier timber, but with thin undergrowth in comparison with other parts of the canal line. This country has but little elevation above the sea.

It is proposed here to make a harbor by running out a heavy stone jetty or breakwater, 900 ft. long, about southeast from the extreme point of the headland mentioned, and another similar jetty, 830 ft. long, located about normal to the beach line. These jetties would be partly in deep water, as the shore slope is very steep. The main harbor, however, would be made by dredging in the alluvial valley of the Rio Grande. This excavated basin would extend 3,000 ft. inland, with a bottom area of 95 acres, and the canal itself, as far as Lock 6, would have an enlarged section with a bottom width of 120 ft. The material for the breakwaters would be trap or basalt obtained from the divide cut, or more probably rock from the promontory alongside.

(To be continued.)



The San Juan River below Castillo Rapids

Wooden Water Mains.

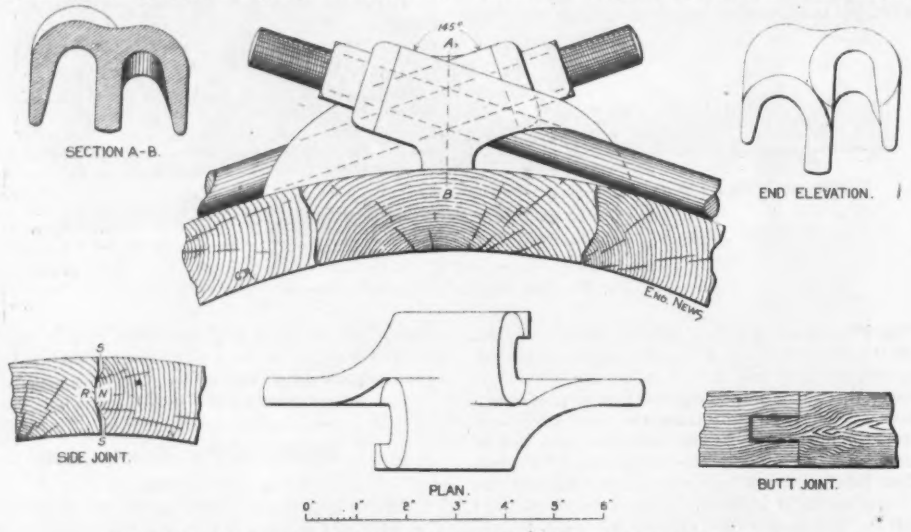
BY A. MCL. HAWKS.

In the early part of this century the use of wooden pipe for water mains was very general, and there are few of our older cities and towns that cannot boast of a water-works system with hollow logs for its mains, which are being dug up constantly in the repair and regrading of streets. After a use or burial of 30 to 80 years they are usually found in a good state of preservation. The exterior may be slightly decayed, but the greater portion of the log is usually perfect. This is especially true when the pipe has lain in marshy or wet ground, and when the pipe has remained full of water, which has kept the wood saturated.

An outgrowth of the hollow log was the stave or barrel pipe—built on the principle of our watertight barrels. One of the earlier examples of this kind of conduit and at the same time one of the best known is that erected by J. T. Fanning, C. E., in connection with the Manchester (N. H.) Waterworks. It is described in his "Treatise on Water Supply Engineering," p. 439; also in "Trans. Am. Soc. C. E.," March, 1877, and in ENG. NEWS, Vol. XIX, p. 333. This conduit is 6 ft. in diameter in the clear and is made of 4 in. Southern pine staves dressed on their edges to true radial lines. In his description he says: "The hoops were made of iron 2½ ins. wide, varying from ⅛ in. to ¼ in. in thickness, and each hoop had two tightening bolts at points opposite each other. The butting joints of the staves were made tight by introducing a thin plate of iron in each. Saw kerfs were cut tangentially ⅝ in. deep across each end of each stave, and pieces of hoop iron ¾ in. wide and ⅛ in. longer than the width of the stave filled the kerf. The ends of the iron plates were sharpened so as to indent into the sides of each adjoining stave. This pipe was first put in use July 4, 1874, and in a personal letter dated Aug. 9, 1890, Mr. FANNING says, "The conduit has been in constant use ever since its construction. I do not know that any repairs have been required in maintaining the conduit. It has been inspected only on the inside,

and has, I believe, always appeared in good condition." He is unable to predict the future life, not having seen the exterior of the pipe, but looks for many years of usefulness. No one has yet advanced any reason why, with complete saturation, the life of a wooden pipe should not be a very long term of years.

Following in this line, several forms of wood pipe have been constructed. To be thoroughly successful the construction must be such as will permit the water to be turned on and off without causing leakage or bringing an undue strain on any part of the pipe. By the form of pipe shown in the illustrations this is fully accomplished. When the staves are first placed in position the nose (*N*) of the tongue comes in contact with the recess (*R*) of the groove, making a water-tight joint. The "cinching" of the bands slightly increases this contact. The spaces (*S S*) are left to accommodate the swelling of the wood and are entirely filled when the staves are thoroughly water soaked. By means of these spaces no undue initial strain is brought on the bands, thus rendering the factor of safety an exact instead of a variable quantity. The butting joint is a groove and tongue of a different form, but acting in a similar manner. As the staves break joints throughout, they make a continuous pipe of uniform strength. Machines, of quite simple form, dress the edges of the staves at



SHOE FOR WOOD PIPE UNDER HEAVY PRESSURE; A. McL. Hawks, Engineer.

one operation and the ends by another. They may be readily set up at any saw-mill.

The bands are wrought-iron or steel rods, with a thread and nut on each end, and are fastened by a shoe of ingenious form. The central rib of this shoe is slightly deeper than the two side ribs, and has the same circular cross-section at the bottom as the rod. It extends to within an inch of tangent points of the rod on the surface of the pipe. In cinching the rods make a slight impression on the wood, and this rib, from its form, takes the same bearing, and continuing this impress tends to make the pipe perfectly circular. When the shoe is in place the two side ribs are just in contact with the surface of the pipe, and preventing any rocking motion. By tightening with a nut on each end of the band an even tension is given and no one part is strained more than another. The size of the bands and their spacing depend on the pressure that the conduit is to withstand.

The uses of this kind of pipe are very varied and its advantages are greater than might seem possible to one who had not investigated its merits. For irrigation ditches of the "arid region" it is rapidly taking the place of flumes formerly used to cross the arroyos so frequently encountered. Safely buried beneath the sand, it presents no obstacle to the raging torrents that occasionally sweep down the gulches, carrying flumes and trestles down before them. Then, too, cloudbursts most frequently occur during the irrigating season, and either hasty, temporary repairs must be made or there may be a partial loss of crops due to lack of water at the time of greatest need.

In the location of ditches it is destined to play a very important part in the future, for it avoids the usual long and costly detours and high flumes and trestles necessitated by a line following the hydraulic grade. It also avoids the loss of head due to the length of conduit which is necessary if the hydraulic grade is followed, and the cost of maintenance and repairs of this extra length of line. A pipe flume (42 ins. diameter in the clear) on the line of the "Phyllis Canal," near Boise City, Idaho, constructed under the supervision of C. H. TOMPKINS, Jr., Engineer for the Idaho Mining & Irrigation Co., crosses a gulch about 60 ft. deep, and by use of this direct crossing several miles in length of canal and a considerable elevation are saved.

Often when a canal has been located down a valley, there are better lands below that point but on the opposite side of the stream, and the only requisite lacking to make a success is an economical method of carrying the water across. To this problem this pipe flume is a solution.

For all kinds of river and channel crossings and for all submarine work this pipe is especially adapted, as it can be sharply bent and twisted without any danger of straining any part or opening any joint. It can be built on shore and launched in sections of any desired length to be joined in place, or it can be built continuously at the water's edge and floated out into the water as fast as built. From its structure it naturally adapts itself to the contour of the bottom and takes curves of 250 ft. radius (and less, according to diameter of pipe), both vertical and horizontal, without any undue strain.

In mountainous, heavily wooded, marshy, or swampy country, which would be almost or quite inaccessible to teams transporting any heavy or bulky articles, and when for that reason no other kind of pipe could be used, this, on account of its lightness and the small size of its parts, can easily be transported and erected in place. By its use water powers that have formerly been considered unavailable are now being utilized.

In gravity systems of water-works the supply has often to be brought from a distant point to obtain sufficient pressure and an abundance of water. The first cost of an iron supply main is often too great to make a gravity system feasible. The use of wooden pipe, however, will often make a gravity system the cheapest, for as its cost in the West is less than half that of iron, it will increase the economical length of the supply conduit to double that of the iron pipe.

Of the questions which arise concerning this pipe, that of its life is most often asked and is the hardest to answer. Reference can be made, however, to the old bored pipes which have so long withstood the ravages of time; to the various forms of submerged wood construction which have remained intact for ages, like the piles of Cæsar's bridge in the Rhine; to the saturated tubs, vats, tanks and tuns that are shown in the cellars of Europe, still perfect after centuries of use. We have also the testimony of such authorities as Mr. FANNING, who says that after 16 years' use of the Manchester wood conduit above referred to, he sees no reason why years should not elapse before the conduit will be useless; and Mr. SCHUYLER, who says, in his report on the Pueblo gravity system (noted in ENGINEERING NEWS, Vol. XXV., p. 53): "If the bands are properly coated, and the pipe is kept full of water, it is practically indestructible and certainly has a longer life than sheet-iron or iron riveted pipe."

The next most frequent question asked is concerning the growth of certain algæ and other forms of plant and animal life, which would tend to destroy the wood or retard the flow. From personal inspection of a pipe while in use, running part full, I can say that after three years' use there was no perceptible growth. The wood had the "feel" that any thoroughly water-soaked wood had—a certain slipperiness, as if it had been greased. And from some rough experiments it seems probable that the coefficient (*n*) of roughness is even less than the universal .009 for well-planed timber. In this pipe there is no rust, no tubercles, no decaying yarn, no irregular joints, as in iron, but one continuous smooth surface.

Another question is, "Can the pipe adapt itself to shocks?" The following unexpected and rather dangerous experiment will serve for the answer. Owing to a lack of proper inspection of the lumber, a part of a line from one of our mountain streams to a Pelton wheel, showed some small leaks. To remedy them, rope chopped up fine and slowly sifted into the water flowing into the pipe was suggested and carried out, with the exception, however, that it was dropped in in one mass. The pipe diminishes in size from 26 ins. to 24 ins., 22 ins., 20 ins. and 18 ins. diameter, and ends at the wheel in a 1¾-in. nozzle under 180 ft. head. Down this contracting passage the wad of oakum rolled, growing more and more compact as the pressure increased, until it finally struck the nozzle with such a blow as to nearly overturn the whole wheel-house and plug the nozzle so tightly that it had to be dug out with a drill. The only damage done to the pipe was the blowing out of about a foot of one stave on a part of the pipe which was under only 50 ft. head. This was at a defect in the stave, and, as the pipe was built with a factor of safety of 2.3, the bands were wide apart under this light pressure. Repairs are very easy, as the bands can be loosened and a new stave sprung into place, so but little time was lost. Any one who has seen cast-iron mains burst from the sudden closing of a fire plug can understand how severe the test was and can realize the strength the pipe must have to resist such shocks successfully.

In regard to the head which the pipe will safely stand, the limit is yet undetermined. The wood is simply the envelope to retain the water, and the resistance to bursting falls entirely upon the bands, which are sized and spaced according to the pressure. With a factor of safety of 4, under 70 pounds pressure, with the bands close together, the stability and rigidity of the pipe seem greater than under 5 pounds with the bands proportionately wider apart.

Curves of 250 ft. radius for large pipes, and of less radius for smaller ones, are readily turned; and by a slight change of staves any moderate curve can be bent. For sharp bends connections with specials are made by a simple plate casting strapped to the pipe—as the pipe is continuous the pull comes on the whole length of pipe.

In a general way anything that can be accomplished by a cast or wrought iron or steel main, can be done more cheaply by the wood conduit.

RONCADOR REEF, or the small island within it upon which Senator MILLER and the Nicaragua Canal expedition were wrecked on March 26, is claimed to be the property of the United States. The *Detroit Free Press* says that on Dec. 7, 1856, a Capt. JAMES JENNET, an American citizen, took formal possession of the island under the act of Congress of Aug. 18, 1856. The legal notice was filed in the Department of State, at Washington, and it was the duty of our government to formally notify all the states interested. No protest is on file, and the claim seems to remain undisputed. JENNET is said to have erected the rambling building of coral rock, the walls of which excited the curiosity of Senator MILLER's party. The island is of no practical use even as a site for a lighthouse, for this should be at the other end of the reef, 9 miles away.

Methods of Working and Surveying the Mines of the Longdale Iron Co., Virginia.*

Professor Rogers says in his preliminary report of 1835 that this deposit has "more of the character of a true vein than is usually the case with ores of this sort." Underlying the ore, the Lower Helderberg limestone should be and is occasionally found as the footwall. Generally, however, the limestone has been replaced with a highly silicious clay, which often runs into sandstone. Overlying the ore and forming the hanging wall is the Devonian shale (No. VIII. of Rogers classification, the Hamilton slate of New York). This formation is encountered in great thickness, one tunnel having been driven upward of

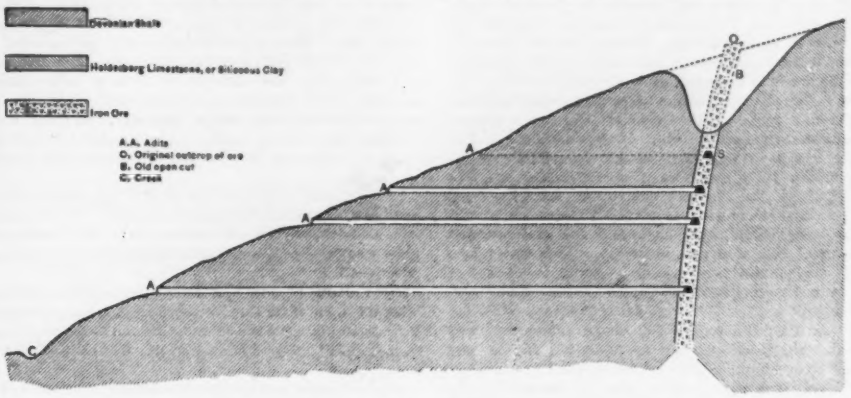


Fig. 1.

1,200 ft. through it to reach the ore. Near the ore its character changes. It becomes so much softer as to be cut readily with a knife, while the color changes to blue, red, yellow or white. Combinations of all four colors are also often met. Upon exposure to the air it swells and crumbles into fine particles, the swelling often being accompanied by the breaking down of one or more sets of timbers in the mine.

The strike of the vein may be said to be that of the mountains, about N. 45° E., while the dip may be anything from zero to 90° in the same mine and within limits a few hundred feet apart. The ore crops along a distance of about 1½ miles, and has been opened in many places. Most of these workings, however, were open cuts, and have long been abandoned, the ore supply being drawn at the present writing from two principal mines, situated, roughly speaking, at each end of the deposit, the one at the lower (southwest) end being much the larger. As the system of working and surveying both mines is the same, its application to the lower mine only will be described.

When mining was begun at this point the outcrop was 500 ft. above the creek level, and the mine was for many years worked entirely by open cuts. As time went on, however, the excavation was carried so deep (130 ft.) that the cover grew too heavy, and it became necessary to obtain the ore by underground workings. It was finally decided to stope the ore from the top down. This plan was adopted in 1881, and has been followed ever since with complete success.

METHOD OF OPENING THE GROUND.

The method of attack is to sink a test shaft upon the ore to the depth at which it is desired to drive an adit. The line of least distance from the surface to the ore at the level chosen (the length of which line is obviously largely governed by the height of the "lift" to be secured) is then determined, and the adit is driven straight in through the overlying shale, to the ore, a distance varying from 300 to 1,200 ft., according to the height above the creek at which the adit is driven. In Fig. 1, which illustrates the general method, the adits are represented, for the sake of clearness, as though driven in upon the same vertical plane at different levels, while in reality their entrances are from one-half mile to a mile apart, and their directions are not parallel. The highest adit was driven directly upon the ore from the bottom of a ravine which was cut across the vein. Its level is indicated by a broken line in the drawing, the adit itself only showing in such a projection to the extent of its shaded cross-section at *S*. The shortest adit (300 ft.), mentioned above, is not shown in Fig. 1, as it was of secondary importance and was not used long.

On reaching the ore, the adit is continued by galleries in both directions, following the bends of the vein. These, it may be remarked, are both many and sharp; many of the sights taken during the survey of the mine being 16 to 20 ft. only in length. Parallel with the main entry or car level an airway is driven at a height of 20 ft. from the bottom of the main entry at the bottom of the airway. As the main entries are 6 ft. high, this leaves a pillar of ore 14 ft. thick between the two levels. At intervals of about 120 ft. on the car level, chutes or winzes are driven up through this pillar to the air-way. These chutes are supplied with spouts and gates for loading the mine cars. Twenty ft. beyond each chute, in the direction of the heading, a second passage, called the man-way, is driven up, to afford means of ascent for the men who are working above.

As the air-way is always connected with the test shaft above mentioned, this system affords a very perfect means of ventilation. Of course it is necessary to keep most of the chutes and man-ways nearest the mouth of the adit closed, in order to force the incoming air to the headings. From the air-way the chutes and man-ways are driven up until they reach the surface in the bottom of the old open-cut workings. This, however, is not all done at once, but only as needed for the working of the mine.

At every 10 ft. of vertical height above the air-way a lateral level 5 ft. high is driven off along the ore, thus leaving a 5-ft. pillar under each drift.

METHOD OF WINNING THE ORE.

When the open-cut workings, mentioned above, were about to be finally abandoned, a grillage of small poles was laid down. This formed a floor resting upon the ore in the bottom of the cut. Outside working was then discontinued and the sides were suffered to fall in upon the grillage, after which the mines were ready for underground working. The system is as follows:

The pillar of ore over the highest level, or in other words, the ore left in the bottom of the old cut, is first attacked and taken out, the roof being supported during this operation by heavy props set up a short distance back of the working face, under the grillage mentioned above, and standing upon a similar grillage placed upon the ore under foot. (Where the vein is horizontal or nearly so, the lower grillage may be omitted, the roof being allowed to fall directly upon the floor, which, in such cases, is the foot-wall.) This row of posts supports the roof until the ore has been taken out for a short distance ahead of them, when a second series is set up in similar manner. It is customary with us not to leave the roof standing, even if the props are strong enough to support it for some time, but to cause it to fall by either "shooting out" the props (*i. e.* breaking them down by means of dynamite) or by drawing them out if they can be saved.

The ore that comes from the face is wheeled to the nearest chute, into which it is dumped. After the top pillar has been robbed for a few feet, generally from 10 to 20, the next one below is attacked in the same way. Every level in the mine can thus be worked simultaneously, the workings resembling a series of 10-ft. steps, as shown in Fig. 2, which is a vertical elevation of a part of the mine. In this figure the shaded portion represents that part of the mine which has been stoped, the remainder being ground opened for mining but not yet stoped. The construction of a cheap floor or grillage of poles is repeated on every level to prevent the sliding of the waste from old caved stopes above. This floor is, of course, not removed after serving its temporary but important purpose.

The ore dumped into the chute descends by gravity to the car level, unless it is stopped by meeting a flat place or "bench" in the vein and consequently in the chute. When this occurs a rehandling becomes necessary, and is carried out in either of the three following ways, as may be best suited to the ground: When the bench is very short, one man can generally handle the ore as it comes down the chute, by shoveling it up and pitching it forward into the steep part of the chute again. If the flat place is too long for this, it is wheeled forward in wheelbarrows and again dumped into the chute. If the bench is too long to permit the economical rehandling of the ore in either of the above ways, a track is laid and a car brought into requisition. In this case the chute is provided with a spout and gate, situated at the end of the steep descent above the bench, and the ore is drawn by means of these out of the chute and into the car, which, when loaded, is pushed forward by hand to the beginning of the second steep descent in the chute and dumped.

When the ore finally arrives at the car level, it is drawn into mine cars, hauled to daylight and dumped upon a horizontal screen of round iron bars, which is set in the top of the ore bin beside the railway. The fine ore falls through the screen into a pocket, while the lumps remaining upon the bars are further broken and sorted by hand and thrown into an adjoining pocket. From these pockets the ore is drawn into cars on the railway leading to the furnaces, the lump ore being taken directly to the furnace bins, while the fine is conveyed to the washer.

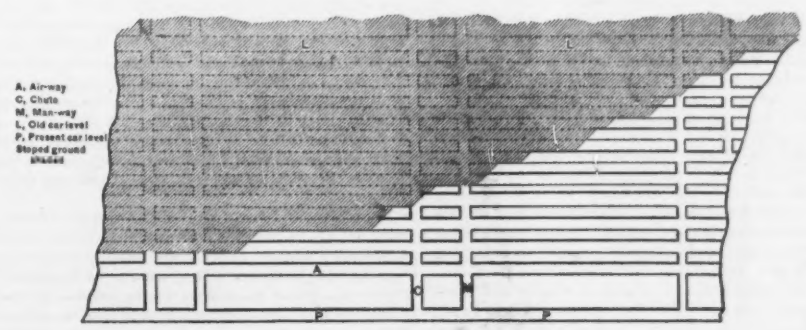


Fig. 2.

METHODS OF SURVEYING.

As will be seen from the foregoing description of the mining, surveying was no easy matter, for the mine was entered at four different levels, and the entrances only of these four adits could be connected by level and transit lines. This left the inner ends "in air." It was necessary, therefore, to survey the four car levels with transit and level, connect their entrances by an ordinary survey, and then find some way of surveying the intermediate workings, the chutes and their lateral levels, so that the inner ends of the car levels might be thereby connected and the accuracy of the work tested. The following method, adopted after thorough discussion, has given perfectly satisfactory results:

A base line was laid down with special care and thoroughly marked for future reference. The bearing of the line was then taken, two instruments being used to check the accuracy of the needles. Starting from this base line, the four entries were surveyed with the transit. The work was commenced in the lowest entry. The instrument having been set up and a back sight taken to the next station behind the one over which the transit was placed, the telescope was revolved on its axis, the vernier screws were loosened and the instrument turned on its vernier plate until the crosshairs bisected the light of the plummet lamp hanging over the station of which the position was to be ascertained. The angle, as indicated on the vernier, was now read, noted and reread, after which the bearing, as indicated by the needle, was noted. If this agreed fairly well* with the course as calculated, the assistant was sent back to the first-mentioned station, the vernier was unclamped, the telescope revolved on its axis and the instrument turned on the vernier plates until the flame was again bisected by the crosshairs. If the vernier then stood at zero, I was reasonably sure that no error had been made in the

* Slightly condensed from a paper by Mr. GUY R. JOHNSON, Longdale, Va., read at the Cleveland meeting of the American Institute of Mining Engineers.

* Of course the presence of the iron rails used in the car-levels renders the needle more or less unreliable. In this connection I would call attention to a somewhat curious experience in connection with the needle bearings. Whenever the work was carried on in a dry section of the mine the needle seemed but little affected by the presence of the rails; but as soon as water was encountered in sufficient quantities to make the track muddy it became totally unreliable, variations of 5° being not uncommon. I was greatly puzzled by this, and finally became convinced that the water and mud, by making a perfect connection between the rails, permitted a greater degree of polarization and consequently increased the effect upon the needle.

angle. The reason for always resetting the instrument to zero was that it was an old-fashioned flat-centered transit, with vernier divided into four arcs of 90° each.

The angle and bearings having been taken as described, the length of the sight was measured with a steel tape. When a chute or a manway was reached a large nail was set in the cap or in the lagging at the intersection of the line of the sight then being taken with the prolongation of the center line of the upward passage. The distance to this nail from the station over which the instrument was standing was then taken, and set down in the "Notes" column, opposite the station from which the measurements were taken. This marked the lower end of the upward passage, or on the line of the transit survey; and in a similar way the entrance of the upper end into the tunnel above (or, in case it ran out into the old workings, its mouth) was noted, when the lines were run in the upper car levels or over the outcrop in the old cuts. By this means the positions of the ends of the chutes which ran from the lower levels up to the higher ones were accurately determined.

The plummet lamp used in this work is of the kind invented by Mr. ECKLEY B. COXE, of the Institute, and described by him in his paper upon "Surveying the Anthracite Mines at Drifton, Pa." (*Trans*., i., 378). The stations in the transit survey were marked with large tinned tacks set in the ties of the track. The ties were chosen rather than the caps, because in these mines they are less apt to be disturbed by movements of the ground. Tinned tacks were employed because they were easy to find, and, being flat-headed, were not readily kicked out by the mules.

Throughout the whole survey the utmost care was used in measuring, a steel tape being employed and every precaution observed to prevent any error, either in reading or through not stretching the tape tightly enough to take out all kinks. In leveling there was nothing special

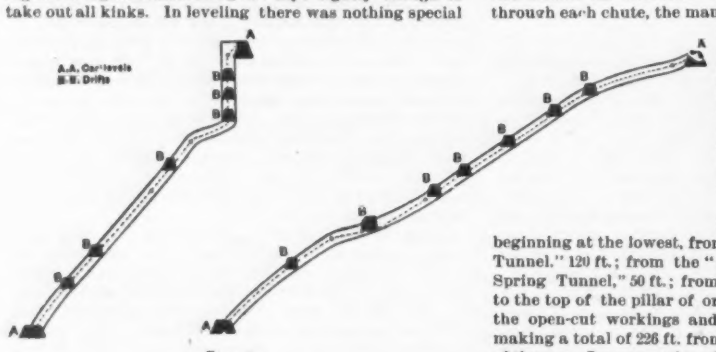


Fig. 3.

to note, the most necessary precautions being to have the target always bright, have plenty of light before it and take short sights. Whenever in the course of leveling, an upward passage was met, the height of the top of the rail was noted, and the same thing was done at its upper end, thus fixing the elevation from top to bottom.

The sights varied from a little less than 3 ft. to 100 ft. By using the above precautions, several miles of underground leveling was accomplished, and in no case was the error, as determined by "checking back" all work, greater than one-tenth of a foot.

In this way the four main levels were surveyed, after which their entrances were connected by level-and-transit lines. The chutes and their lateral levels alone remained to be surveyed, in order to enable us to make a complete map and test the accuracy of the foregoing work. To do this with transit and level was out of the question, both on account of the roughness of the chutes and also because they were much too small—so small in places that a man could scarcely crawl through them. But the ore in this mine being brown hematite and non-magnetic, permitted the use of the magnetic needle on all levels and in all chutes where there were no rails. It was accordingly decided to use a hanging compass, in connection with a clinometer, for this portion of the survey. After several trials I adopted the following system of using these instruments as giving the best results. Two conditions had to be met: first, the method adopted must permit accurate, yet rapid work in order to interfere with the miners as little as possible; secondly, by reason of the rough and varying character of the ground the apparatus for suspending the compass must be both simple, light and adaptable to varying requirements. As fulfilling these conditions, the following articles were used: 100 feet of strong linen line, about one-eighth of an inch in diameter, braided to prevent much stretching or twisting, and wrapped upon a light reel, which could be easily carried. This, with a plummet, a hatchet and nails, and three strips of wood, respectively 4, 5 and 6 ft. long, constituted the equipment. The survey of a chute was preferably begun at the bottom. The distance from the top of the rail to the nail in the cap or the lagging left when the transit survey was made was first noted. One end of the cord was then fastened so this rail and the reel was carried forward, up through the chute, until the curving, either horizontally or vertically, of the chute caused the cord to diverge from the center line. One of the three wooden strips was then wedged tightly across the chute and the cord was attached thereto and drawn very taut. A brass clip was then fastened to the line to prevent the instruments from slipping to the bottom. The compass was next suspended, the course was taken, and the compass having been removed, the clinometer was substituted. The angle of inclination having been noted, the clinometer was taken off and the distance from the bottom up to the strip was measured with a steel tape, always along the line. In case one or more levels were passed in the course of the sight, the distance to the center of each was noted, as was also the distance they had been driven along the ore. If they had been cut through to the next chute, then the distance from center to center between the chutes was taken as affording another check upon the work in the final plotting. All the measures having been taken, the line was loosened at both ends and the rear end was fastened to the strip where the forward end had been attached, while the forward end was again carried ahead and tied to another strip. At the end of the second sight the first strip was removed and carried forward, to be used again. If the chute was timbered, the cross-sticks were nailed to the timbers instead of being wedged across. In case the chute was vertical, the plummet was used, and only the vertical measures in the chute needed to be taken. Fig. 3 shows vertical projections of two cross-sections on chutes in the mine, and gives an idea of the varying slopes. The dotted lines represent the survey lines.

Upon reaching the top of the chute connection was made with the transit survey by fastening in the last sight the forward end of the cord to the nail left when the transit survey was made, in the line of the chute. By this means an accurate line of surveys was carried through each chute, the manways being located by offsets from the chutes, and it only remained to reduce the slant distances, as measured along the cord, to their vertical and horizontal values. This was done with a trigonometer, by the use of which a vast deal of calculation was avoided.

The vertical heights between the four car levels are, beginning at the lowest, from "Big Bend" to the "Store Tunnel," 120 ft.; from the "Store Tunnel" to the "Alum Spring Tunnel," 50 ft.; from the "Alum Spring Tunnel" to the top of the pillar of ore left between the bottom of the open-cut workings and the "Craft Tunnel," 56 ft., making a total of 226 ft. from the lowest level to the top of the ore. I may say, in addition, that we are now driving a tunnel to take in another 120-ft lift, the ore having been tested to that depth and still continuing down.

In plotting the foregoing work everything was reduced to terms of the magnetic meridian. The main entries were first plotted, after which the chutes were laid down. It is evident that unless the work was correct, if the chutes were plotted from the bottom up, their top ends would not fall upon the corresponding points determined in the transit survey. This they did with sufficient accuracy to make a reliable map of the mine.

Two projections of the mine are always made, a ground plan or horizontal projection and a vertical projection. The map once having been made, it is a very easy matter to keep it up to date, a week being sufficient to survey a year's progress, both in the new work and in stoping. The first survey and the subsequent plotting took about 3 months.

In conclusion, let me say, for the benefit of those who have not used a hanging compass, that though the above description sounds delightfully simple, actual practice was far from being so. The character of the ground to be surveyed, which is always rough, sometimes wet, and occasionally dangerous, greatly enhanced the difficulty of doing accurate work. The keeping of the note-book in respectable shape—in fact, in any sort of shape so that it can be read afterward—is also often almost an impossibility, owing to the streams of water which are caught by the breaking of the ground above and pour down through the chutes, generally bringing with them a *sufficient* amount of mud. Nevertheless, if proper care be taken, this system of surveying the chutes affords very satisfactory results, in comparison with which, of course, the incidental difficulties and annoyances sink into insignificance.

Some Methods of Meeting the Ordinary Requirements of Railway Maintenance.

(*Continued from page 548.*)

To repair an abutment which has failed by partly overturning or "bulging," a "jacket" of masonry, upon a sloping and unyielding foundation, and with plane of beds of courses square with a face battered 6 ins. to 1 ft., as shown in Fig. 17, is often efficacious and very economical, as compared with the removal and rebuilding of the structure. This jacket acts, of course, only as a brace; but carrying the trusses or girders on bents, tearing out a part of the old work, grouting with thick grout, and putting on new bridge seats, this form of repairs seems calculated to be permanent. The masonry of the jacket should be bonded as well as possible with that of the abutment by means of iron bars bedded in the courses. If the stone in the old structure has disintegrated, however, nothing can be done with good results except to tear down and rebuild.

To repair piers when failure results from crushing of stone there seems to but one practicable plan, *i. e.*, to support the superstructure and tear out and rebuild. If the trouble results from settlement of foundations, this also seems to be a case beyond repairs, properly so called; but sometimes, by waiting and keeping the bridge bearings leveled by iron shims and timber, a point will be reached at which the settlement ceases. If this settlement results from scour, the natural remedy will be by using "rip rap;" or, if this obstructs the waterway too much, a belt of sheet piling, well driven and held by wales and rods through them running across the ends of the pier and secured to ring bolts in the masonry, and filled in with broken stone, will sometimes carry the scour line down far enough to insure safety. Fig. 18 illustrates the two methods.

[Mr. ROBERT L. HARRIS' method of injecting grout into sandy or other suitable foundations (ENG. NEWS, Mar. 14, 1891) also deserves consideration when the failure results from weakness of foundations which cannot otherwise be cured.—ED.]

Piers when of sufficient length to involve a sufficient weight, *i. e.*, if for two or more tracks, can generally be built with merely a round end and the customary batter of ½ in. to 1 ft., as shown in Fig. 19. But if narrow, as for a single track, a starling, as shown in Fig. 20, with a 45° or sharper angle and a curve or angular nose, a foot or two above and below the ice line, is, it is thought, safer, especially if the foundation is upon piles with a short hold in soft material. This is necessary to decrease pressure from ice and drift wood and to add to the weight resisting such pressure. Attention is called to the advisability of undercutting edges of the starling stone to prevent it from chipping and in order to hold the pointing. These starlings may be of any of the shapes shown in Fig. 21, avoiding winding surfaces by keeping the axial length of the starling equal to one-half the thickness of the pier at all points in its height.

Upon the very important subject of foundations, Fig. 11 is submitted for consideration, as showing the method in ordinary use for abutments, with the additional feature of projection of footing or timber in front of neat work.

A convenient formula for the [*safe*, not ultimate.—ED. bearing power of piles is:

$$\text{Bearing} = \frac{2 \text{ wt. of hammer in lbs.} \times \text{fall in feet}}{\text{last set in inches} + 1}.$$

[This formula was first proposed by ENGINEERING NEWS in its issue of Dec. 29, 1888, and further investigation has only tended to confirm our belief that it is the safest and best of all pile formulas, never leading to great excess of strength, yet never leading to insufficient support. It assumes, of course, that the penetrations have been for a number of blows reasonably constant.—ED.]

This formula gives 14 tons safe load for a 1-ton hammer with a 20-ft. fall and a last set of 2 ins., which is sufficiently small penetration to get, since in one day or less after driving this bearing would in almost any kind of material be double that found above and since further driving is apt to merely shatter the pile. Roughly, then, 15 tons per pile may be taken as its capacity in estimating the number needed in ordinary clay or gravel, this estimate to be corrected after the first day's work by trying the pile for the above formula after 24 hours' rest. It is also well to remember that in any ordinary piece of masonry the weight of the masonry itself is by far the most considerable component of the load on the foundation; and that while in a pier the entire load can be considered uniformly distributed on all the foundation piles, in an abutment, bearing sufficient for this entire load should be provided under the three front longitudinal timbers, or on the three front rows of piles. Three thousand lbs. per sq. ft is enough to allow as the safe bearing capacity of timber on saturated clay or gravel, and, as noted above, 14 tons per pile supported by skin friction, as is generally the case.

Piles when used in ordinary gravel or clay, as they can be with advantage in fresh water, can be cut off at the level of the highest point of the bottom by means of a circular saw working on a vertical shaft set in the leaders of a pile driver and driven by its engine. They may then be filled in with broken stone; a box caisson may be placed upon them; the masonry may be carried up and completed, and the first scour allowed to take place, the hollows formed being then filled with angular stone as heavy as a man can throw in by hand. The scour generally takes effect as sketched in dotted lines in Fig. 20, and the broken stone repairs the damage permanently; while, if deposited before the scour, it would not be where needed. This is, of course, true only in ordinary streams and rivers with clay or gravel bottom, shifting sand with a rapid current requiring excavation by open or pneumatic caissons.

Except when driven in very soft bottom, the heads of piles should be protected from splitting, as soon as their points have entered the bottom, by using a ring of iron

about 1 in. thick by 2 ins. wide. A very good substitute is two or three turns of telegraph wire laid on top of the pile, near its edge, and sunk into the end of the timber by a light blow of the hammer. [Sharpening the ends of piles and shoeing them with iron has very rarely a good effect. —ED.] Fig. 22 illustrates two forms of cofferdams in common use, and attention is particularly called to the dovetailed sheet piling, either composed of planks or cut from single timbers with cleats spiked to them (the two former kinds being preferable) as being on the whole the most reliable and least troublesome. The iron point does away with puddling of clay or gravel, and closes the triangular openings left by the ordinary point.

Any work in a cofferdam of magnitude requires really two kinds of steam pumps, one or more stationary with centrifugal or direct action to steadily exhaust and keep the water out, and one with pump (centrifugal or direct) above water and with flexible suction hose to reach the low corners of bedrock and exhaust the last few inches of water.

If a considerable current of water is found on the bedrock, a small temporary dam of clay can often be carried around the first stone laid and enlarged for the next one, water being kept out and transferred from this dam to the main dam by hand pumps, until the face stone of a course is set. Then the pumps can be stopped and concrete can be deposited for backing, and the water may be permitted to rise and be pumped out next day. The heaviest cement obtainable is the best, if this plan is followed, and double the usual quantity should be used in the concrete.

A good expedient for caulking leaks in a dam in use is to have an open box filled with horse dung and attached to a handle by which it may be pushed down until it is over the leak. The box may then be withdrawn, when the pressure of the water will force its contents into the leak and close it more or less thoroughly. It is also often necessary to sheet-pile around the inside of a corner of any form of cofferdam, or to build a small clay or pile dam to head off a leak. It is to be remembered, in all forms of puddled dam, that the puddling only is for the purpose of stopping the water, and that the sheet piling and timber are to protect the puddling from scour and to hold it in a compact mass: also that dovetailed piling is the only kind which really presents an appreciable obstacle to the entrance of water. In cases where dovetailed piling cannot be used—as in case of a scoured rock bottom—the joint between the puddling and the bottom is the difficult feature. The utmost care is then required in clearing off the bottom between the timber walls and in carefully consolidating the clay in layers of not more than a foot all around the dam, each layer being "cut" before the next one is deposited, to make a bond between them. In a permanent structure, gravel puddle may be best, as is claimed; but where the dam is, as usual, for temporary use, clay or clay with gravel well mixed in to help resist erosion from water is preferable.

For pier foundations in rivers where the bottom is rock which can be leveled, or where water is deep and there is good holding ground for piles, a box caisson, as illustrated in "Baker's Masonry Construction," is generally preferable to any form of cofferdam.

[When the water is under 5 or 6 ft. depth, on rock or other hard bottom, and the current is not swift, our observation is that a plain earth fill is often the best cofferdam, and this is especially so when the rock is uneven.—ED.]

(To be concluded.)

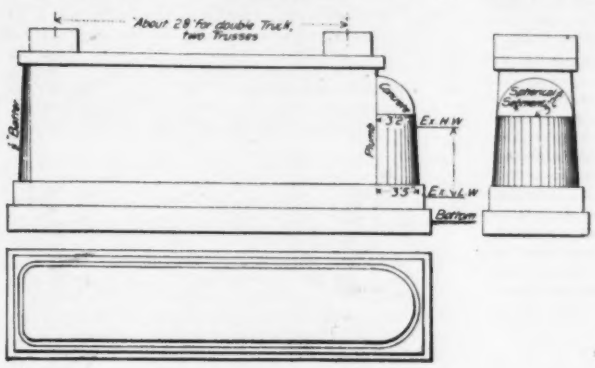


Fig. 19. Piers for Double Track.

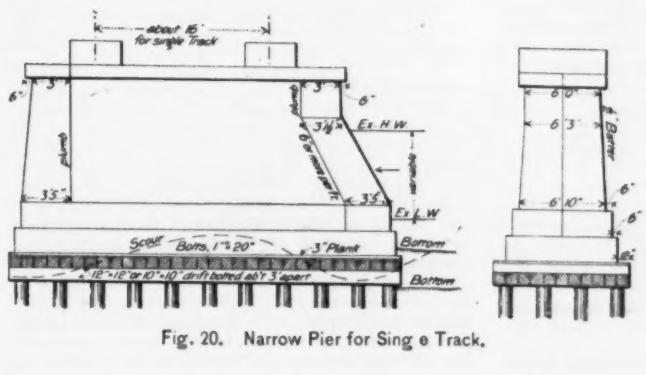


Fig. 20. Narrow Pier for Sing e Track.

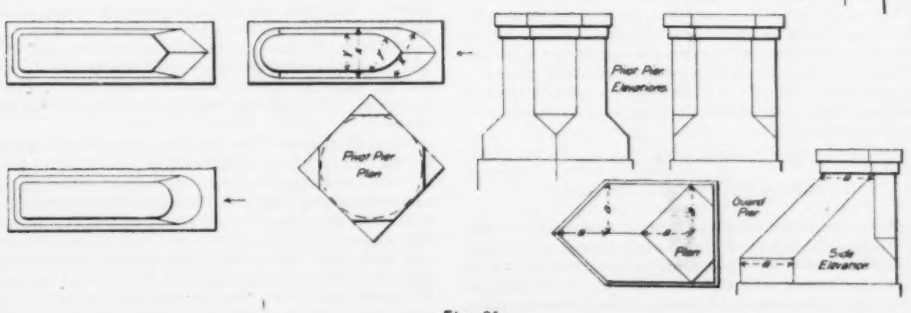


Fig. 21.

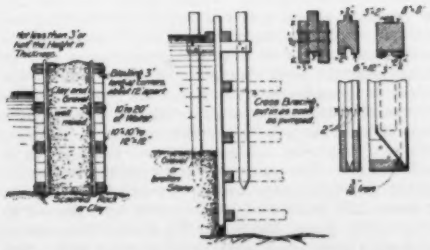


Fig. 22. Two Forms of Coffer Dams with Sheet Piling.

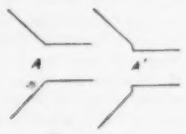


Fig. 11a.
(Omitted from page 548.)

Fig. 17.

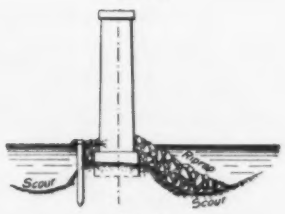
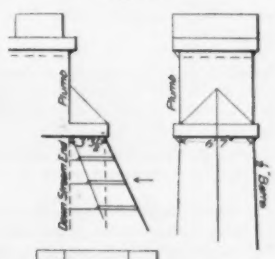


Fig. 18.



PERSONALS.

Mr. A. F. HARLEY has been elected City Engineer of Jacksonville, Fla.

Mr. WM. H. BLOOD has been appointed Assistant Superintendent of the Long Island R. R.

Mr. F. C. HORN has opened an office in the Exchange Building, Chicago, Ill., as engineer and contractor.

Mr. GEO. EMMETT, of Brattleboro, Vt., has been appointed Superintendent of the Watervliet Turnpike & Railroad Co., of Albany, N. Y.

Mr. H. G. KELLEY has been appointed Resident Engineer of the St. Louis Southwestern Ry. Co., of Texas. His headquarters are at Texarkana, Tex.

Mr. J. A. BARNARD, Assistant General Manager of the Cleveland, Cincinnati, Chicago & St. Louis R. R., has been appointed General Manager of the Peoria & Eastern R. R.

Mr. JOHN H. MARS, formerly Constructing Engineer at the Novelty Iron Works, and who was engaged in building fortifications along the Potomac during the civil war, died June 3.

Mr. W. A. PRATT, Engineer of Maintenance of Way on the Pittsburg division of the Baltimore & Ohio R. R., has been transferred to the Philadelphia division, and will be succeeded by Mr. C. C. ELWELL.

Mr. N. W. EAYRS, M. Am. Soc. C. E., late Resident Engineer of the Terminal Railway Association, of St. Louis, Mo., has been appointed General Manager of the Wheeling Bridge & Terminal Ry. Co., at Wheeling, W. Va.

Mr. B. K. VERBRYCK, Superintendent of Motive Power and Equipment of the Chicago, Rock Island & Pacific R. R., died at Chicago, Ill., June 2. He was an ex-President of the Master Car Builders' Association. Mr. C. F. WILSON, General Master Mechanic, has been appointed to succeed him.

Mr. J. IMBRIE MILLER, M. Am. Soc. C. E., in charge of one of the parties of engineers sent out by the Intercontinental Railway Commission, has arrived in Peru, and was presented to the President. He will proceed at once to Quito, and there divide his forces; one party working north to meet a corps coming from Mexico and the other going southward, via Cerro di Pasco and Buzco, toward the Argentine Republic.

Col. ALFRED WAGSTAFF, late State Senator and Colonel of the 91st N. Y. Regt. during the war, was elected President of the Board of Brooklyn Bridge Trustees on June 8. The election was the result of a little surprise arranged by Mayor GRANT and the New York trustees for the Brooklyn members, who were in the minority at the meeting. Mr. JAMES HOWELL, the late President, was elected Vice-President. Since 1875 the management of the bridge has been exclusively in the hands of Brooklyn men, Messrs. MURPHY, KINGSLEY and HOWELL.

Mr. CHAUNCEY VIBBARD, of New York, who was at one time a prominent railway man and financier, died at Macon, Ga., June 5, at the age of 80. He was appointed General Superintendent of the Utica & Schenectady R. R. in 1848, and foreseeing the future growth of railway traffic, he originated the movement which resulted in the consolidation of a number of connecting railways to form the New York Central railway system, of which he was General Superintendent until 1865. In 1862 he was appointed by the Secretary of War as Military Director and Superintendent of the Railways of the United States, being authorized to take and use any equipment needed for military transportation. After his resignation from the New York Central R. R. he became a member of the railway supply firm of Vibbard & Foote. He was a director and stockholder in the original elevated railway in Greenwich street, and a director in the Central Branch of the Union Pacific R. R. Co.

NEW PUBLICATIONS.

— *Key to Steam Engineering.* A thorough and exhaustive catechism of the steam engine and boiler, and practical ideas gathered from 24 year's experience with the steam engine, by W. R. B., M. E. Also, *The Combustion of Coal*, chemically and practically considered, by H. S. W. Boston, 1891. Mason Regulator Co. In one volume, leatherette covers, 4 × 6½ ins., pp. 90. 30 cents.

This little handbook is intended to impart a general knowledge of the principles of steam engineering to those who find the technical and mathematical terms of the ordinary books on steam engineering beyond their comprehension. The trouble with most books of this class, "written by a practical man for practical men," is that along with more or less valuable matter some very serious errors are generally lugged in. But in the present volume, so far as we have been able to find, the principles which it is desired to teach are correctly given, and there are very few statements which deserve criticism. The first part of the book is in the form of a catechism, in nine

chapters, devoted to Air, Water, Fuel, Steam, Boilers, Engines, Engineers [this chapter is in the table of contents but not in the book], Belts and Shafting, Speed of Pulleys, Tables, etc. The second part of the book contains a short and good paper on the combustion of coal. The author has felt obliged to include so much of the chemistry and the theory of combustion that we fear this part will not be properly valued by the practical men for whom it is intended. It is sound doctrine which the writer gives, however, and the subject is one with which engineers are not too familiar. The most serious fault with the book is the absence of any index; in a book intended for the use of practical men, who are not accustomed to hunting up information in books, this is a surprising error, and one which the publishers ought to rectify before issuing any more copies.

The hand-books and pocket-books generally published by manufacturers or dealers in machinery or other merchandise which we have seen are filled up more or ess with advertisements, and are published as advertising schemes. It is due to the Mason Regulator Co. to say that there is not an advertisement of any sort in the book, and no reference whatever to any firm or company is made in any part of the book. The price at which it is sold is certainly low for the amount of matter contained.

—*Thomson Meter Co.*—Some neat little pamphlets are being issued monthly by this company, describing the Thomson water-meter and the service it has performed. A recent one, entitled, "Durability; Efficiency," describes tests of the Thomson meter made by Messrs. A H. SALISBURY, Superintendent of the Lawrence, Mass., Water Board, and by A. W. F. BROWN, Water Registrar of Fitchburg, Mass., in each of which over a million cu. ft. of water was passed through the meter. In the latter trial, after 1,000,526 cu. ft. had passed, the meter was tested and found to have an error of 2% when the escape orifice was $\frac{3}{8}$ in. in diameter and 14% when the orifice was $\frac{1}{2}$ in. in diameter. The test is now being continued and the meter has already made a good start on its second million feet. In measuring a million cu. ft. the disk of the meter makes over 660,000,000 vibrations, and every point in its periphery travels over 15,000 miles.

—*Pantobiblion; an international bibliographical review of the world's scientific literature.* A. Kersha, C. E., Editor. Published monthly at St. Petersburg, Russia (Fontanka, 64). Yearly subscription, 24 shillings, postage free, 8vo, 287 pp. In this work the editors attempt the difficult task of presenting a classified list of all new scientific books, published in all the languages of the civilized world; a series of critical articles on the leading publications; a review of the current periodical literature, with the contents of the chief magazines, etc., devoted to the applied sciences; a critical review of the leading articles in these periodical publications, and finally, short notes on current facts concerning scientific literature. The first number contains about 1,200 titles of new books, 80 critical reviews of leading books, and an index of the contents of 270 periodicals of a scientific nature. The titles of all new books and the "critical reviews" upon them are given in the languages of the authors of the books. And the same rule is followed with the "contents" of the periodicals. The English reviews are generally good for the space they occupy; but they are evidently written by one not an expert in the use of the English language, and from a Continental standpoint. The list of new books is a useful one, but is probably as incomplete as the list of periodical literature, which treats of only one English or American journal devoted to engineering, and that is *Indian Engineering*. But considering the very broad field before them, the publishers deserve credit for the generally good work performed in this first issue.

—*Tube-Frame Goods Wagons of Light Weight and Large Capacity, and Their Effect upon the Working Expenses of Railways.* M. R. JEFFERDS. Excerpt Minutes of Proceedings of the Meeting of the Institution of Mechanical Engineers, London, Oct. 29, 1890; 8¼ × 5½ ins., pp. 53, plates 10.

This is the publication in pamphlet form of the paper read in October last by Mr. JEFFERDS, who is general manager of a company now introducing freight cars of the American type into England. Mr. JEFFERDS naturally considers that the use of these cars will be very beneficial to the railway companies and the shippers, and there can be no doubt that there is a large field for them for certain kinds of freight, such as coal, ores, etc., but for the smaller local shipments the present short cars will probably continue to be used. Mr. JEFFERDS' cars are of a patented form, with frames built of tubes, and these cars are in use to a limited extent in this country; but his arguments, of course, apply to the American system of long cars, and not to any special class of construction, although certain advantages, especially as regards economy in repairs are claimed for the tubular-frame cars. The pamphlet contains the discussion on this paper, including a note from Sir JAMES RAMSDEN, the vice-president, stating that the tube-frame cars had been in constant use on the Furness Ry. for nearly two years, carrying traffic from the steel works to the docks, their regular load being 30 tons, while the weight of the car was only 8.3 tons. The repairs had been practically nil, and the cars had given him such satisfaction that he had ordered a further number. There is certainly great room for improvement in the freight rolling stock of English railways.

—*Interstate Commerce Commission Proceedings.*—Discrimination Between Connecting Lines. In this case the New York & Northern Ry. Co. brought complaint against the New York & New England R. R. Co., charging it with violating the provisions of Paragraph 2, Section 3, of the Act to Regulate Commerce by breaking an agreement for the through billing of freight destined to New York City from points on its lines over the lines of the complainant, and entering into an agreement with the Housatonic R. R. Co. whereby such freight was billed over the lines of that company to Wilson's Point, and thence shipped by the water line of the New England Terminal Co., owned jointly by the New York & New England R. R. Co. and the Housatonic R. R. Co., to New York City. The Commission held the complaint valid.

—*The Topographer; his instruments and methods.* By LEWIS M. HAUPT, A. M., C. E., Professor of Civil Engineering, University of Pennsylvania. Revised and enlarged edition, 8 vo., pp. 247, with 77 illustrations. Price reduced from $4 to $3, post paid. Orders sent to the author, or to H. C. Baird & Co., 810 Walnut street, Philadelphia, publishers. For 50 copies 40% discount on price.——This edition is brought up to the latest practice, and includes, as an appendix, the application of photography to surveying. The tables have also been revised and extended. This is the fullest work on this subject published; and is one that the younger engineers should own, for the valuable matter contained, covering the whole field of surveying; and the older engineers would find it a good thing to refer to.

TRADE PUBLICATIONS.

Tobin Bronze.—The Ansonia Brass & Copper Co. 19-21 Cliff St., New York.—A pamphlet giving the characteristic of this composition; its weight in sheets and rods; tests by Prof. J. E. Denton and N. O. Olson, of Fairbanks, and many testimonials as to its use. This bronze is used for ship sheathing and fastenings, pump rods and pump linings, tube sheets and a variety of other purposes.

—*Catalogue of Brown & Sharpe Mfg. Co., and of Darling, Brown & Sharpe, Providence, R. I.*, 1891. 3½ × 5½ ins., pp. 228.

This year's catalogue of this well-known firm is in the same form as its predecessors. Among the new things described are new styles of milling, chucking and ear-cutting machines, new sizes of milling-machine collets, dieholders, milling cutters and metal slitting saws. A 'soda kettle" for cleaning tools covered with grease and dirt is among the new ideas and looks as if it might be a good one.

—*Boynton Bicycle Railway System.*—Boynton Bicycle Railway Co., New York; paper, 8 × 5½ ins., pp. 48; illustrated.

This pamphlet contains a description of the bicycle railway, with various methods of construction, adapted to different classes of lines, and also particulars of locomotives and rolling stock of various kinds. The application of electric traction to this system is also referred to. Details of the Boynton railway were given in ENGINEERING NEWS March 2 (pp. 185 and 193), 1890. A short line on this system has been built near Coney Island, N. Y., and was opened last year.

SOCIETY PROCEEDINGS.

New England Water-Works Association.—The tenth annual meeting of the Association opened at Hartford, Conn., Wednesday, June 10, and continued until the following Friday. The meeting was called to order at 3.30 P. M. by President A. P. Noyes, West Newton, Mass. About 70 members and guests were present at the first session. A song from Messrs. Pratt and Munroe, Cambridge, Mass., who supplied vocal music during the meeting, was next listened to. A pleasant address of welcome was delivered by Mr. H. C. Dwight, mayor of Hartford. Mr. Ezra Clark, president of the Hartford Water Board, was called upon and made a brief speech. The following were elected to the membership of the Association:

Resident active: J. Allen Butler, Portland, Conn.; G. A. P. Buckram, Norwood, Mass.; J. L. Congdon, East Greenwich, Conn.; W. P. Ellison, Newton, Mass.; A. R. Hathaway, Springfield, Mass.; S. P. Griffin, Lowell, Mass.; Francis Hunnewell, Brookline, Mass.; E. C. Nichols, Reading, Mass.; Richard Baldwin, Terryville, Conn.; W. P. Sweet, Terryville Conn. Non-resident active: M. A. Brown, Perth Amboy, N. J.; E. W. Hart, Council Bluffs, Ia.; Edward Dolan, Troy, N. Y. Associate: J. E. Lynch, with E. Hodge & Co., East Boston, Mass.; Holly Manufacturing Co., Lockport, N. Y.

In his address President Noyes stated that the Association now has a membership of 360, of which 281 are active, 5 honorary and 74 associate, a net increase of 25 members during the year. Attention was called to the desirability of paying the editors of the journal for their services, and it was recommended that permanent headquarters be secured. The President stated that there was a balance in the treasury above bills due and unpaid of about $2,000, a gain of about $900 over last year. The reports of the Secretary and Treasurer were read and accepted. The President appointed Messrs. G. F. Chace, F. H. Crandall and W. H. Richards as a committee on the collection and distribution of blue prints.

Communications were read by the Secretary and discussed by the members as follows: A communication from Mr. J. M. Diven, of Elmira, N. Y., President of the American Water-Works Association, regarding the appointment of a committee to co-operate with similar committees from the American Water Works Association, American Society of Civil Engineers and the National Board of Health for the investigation of "Animal and Vegetable Growths Affecting Water Supplies." The matter was referred to the Executive Committee, with power. A communication was read from Mr. F. A. W. Davis, Indianapolis, Ind., regarding the formation of an inspection and guarantee company and the application of the insurance principle to repairs. Mr. W. G. Richards, New London, Conn., made a motion by which this matter was dismissed without action. Several communications were next read inviting the Association to meet at Holyoke, Mass., next year. Action was deferred until Thursday morning.

The report of a committee on the standing of active and associate members was next read. Amendments to the constitution were recommended, which necessitated the reference of the matter to the Executive Committee.

A paper was read by Mr. F. C Coffin, C. E., Boston, entitled "Standard Flanges for Water-Pipes." Attention was called to the lack of uniformity in pipe from different manufacturers. It was suggested that a committee from the Association confer with the American Water-Works Association and the engineering societies regarding some plan for devising a standard. The general subject of the design of flanges was discussed briefly.

Discussion was invited. Mr. Henry G. Meyer, of New York, suggested that it would be well to hear from representaives of foundries, if any were present, as they could tell just what difficulties are in the way. No one responded, and the meeting adjourned until evening.

WEDNESDAY EVENING.

The session opened with a paper entitled "An Experience with a Water Hammer," by Mr. E. F. Farnham, Sharon, Mass. In Mr. Farnham's absence the paper was read by Secretary Coggeshall. Mr. Farnham stated that water was pumped through a 6-in. main about 1,500 ft. long, to a standpipe. There being trouble with hammer, a vacuum chamber was added to the pump, but the hammer was not stopped. It was finally discovered that too much water found its way to the air chamber, and after excluding this the hammer was stopped.

The next paper was by Mr. H. G Holden, Nashua, N. H., and was entitled "Are Lead Pipe Connections for Iron Service Pipes Desirable?" Mr. Holden thought that the common lead goose-pipe connections might well be dispensed with, and that by so doing a dollar might be saved on each connection. At Nashua lead is not used, and service pipes are laid from mains to and through the cellar wall. By following his method when a stoppage occurs in the service a rod can be run from the cellar through to the main and the obstruction removed. Mr Holden believed that goose necks are not used at Cambridge, Mass., or Pawtucket, R. I., where wrought-iron pipe is used for services.

In the discussion which followed Mr. W. F. Codd, Nantucket, Mass., stated that he thought connections could be used for water as well as for gas, but he thought lead connections were really cheaper. Mr. W. G. Richards, of New London, Conn., found while making excavations that gas service pipes pulled out. Mr. Holden remarked that he thought most cities that could afford it used lead pipe, but that, according to the *Manual of American Water Works*, about three-fourths of the works use iron pipe. Mr. R. M. Gow, Medford, Mass., thought it not advisable to do away with goose necks, owing to the fact that settlements would occur and that the lead would accommodate itself to the settlement. Mr. G. A. Stacey, Marlborough, Mass., thought that the question was largely affected by circumstances, such as the character of the soil. But generally he considered lead the best, as it can be bent. Gas mains are generally under less pressure than water, and, perhaps, less attention is paid to leaks in gas pipe. Mr. Holden stated, in answer to a question, that some of his connections had been in for about 20 years. The connections formerly were made from the top of the pipe, and until recently no corporation cocks had been used. Galvanized iron is used for services. Mr. Henry Meyer and Mr. Peter Milne, both of New York, expressed themselves as in favor of the lead connections.

(*To be continued.*)

Master Car Builders' Association Annual Convention at Cape May, N. J.

The twenty-fifth annual convention of the Association was called to order at the Stockton Hotel, Cape May, N. J., at 10:15 A. M., June 9, by President John Kirby. The calling of the roll showed 71 members present. President Kirby in his address recommended the appointment of a committee of five with power to select not more than five different kinds of the M. C. B. automatic coupler for use

by the Association. The excessive use of defect cards is becoming a serious fault. When the space on two cards is required to enumerate the defects of a car, it is time it was repaired before doing any more service. The use of the old size of defect cards increases the clerical labor in car departments. The reprehensible practice of adding defects to the face of a card already attached is nothing better than forgery; and those who have been guilty of it should repent and do so no more. It is getting to be too much the custom to ask the help of the arbitration committee. No less than 18 cases were referred to them during the past year, nearly all of which might as well have been settled by the parties interested.

While independence and originality are to be encouraged, it is to be remembered that every change in car construction means expense and difficulty in repairs. The term M. C. B. standard is too much of a misnomer. One of the most gratifying things of the past year is the progress made in the application of M. C. B. couplers and automatic brakes.

The report of Secretary Jno. W. Cloud showed a total membership of 278 against 264 a year ago. There has been an increase of 2 active and 12 representative members. The total number of cars now represented in the Association is 982,970 against 918,861 a year ago, an increase of 61,109. Of this increase 8,240 cars were owned by new railway companies joining the Association.

The expenses during the last year were $5,665, and there is now a balance in the treasury of $2,644.34.

Messrs. Wm. Turreff, R. H. Wilbur, Benj Welsh, Wm. McWood and E. B. Wall were appointed a nominating committee, and Messrs. F. D. Adams, E. Chamberlain, J. N. Barr, Wm. Forsyth and Jno. Mackenzie were appointed a committee to report subjects for discussion at the next annual meeting. Messrs. W. H Day and Thos. Sutherland were appointed a committee on Resolutions, and Messrs. E. D. Bronner, E. D. Nelson and G. W. Rhodes were appointed an Auditing Committee. Messrs. H. G. Prout and D. L. Barnes were elected associate members.

In accordance with the recommendations of a joint committee, the by-laws were changed to make the date of the Annual Convention the second Wednesday in June, the place of meeting to be determined by a joint committee of the Master Car Builders' and Master Mechanics' Associations at least six months in advance of the meeting.

The Convention then took up the reports of the committees on technical subjects as follows:

METAL FOR BRAKE SHOES.

The committee reaffirmed their statement of last year that the shop tests then reported should be confirmed by a series of road tests. These, however, cannot be made without a large expenditure of time and money. It is true one or two of the Western roads last year offered facilities for carrying out the tests, but the committee has not felt justified in asking for their renewal this year The expense attending such tests cannot well be provided for except by some action of the managers of railways represented in the Association. The committee, consisting Messrs. of G. W. Rhodes, B. K. Verbruck and E B. Wall, therefore felt that they cannot complete the investigation, and asked to be discharged.

LETTERING FREIGHT CARS.

Messrs. E. W. Grieves, G. W. Demarest and R. D. Wade submitted a full report describing a standard system of lettering for box, stock, gondola and flat cars.

A brisk discussion came up over the clause of the report recommending the placing of the numbers of the cars on the car doors. This was struck out, and the report was ordered submitted to letter ballot.

PRESSED STEEL AND MALLEABLE IRON IN CAR CONSTRUCTION.

The following is an abstract of the report: *Pressed Steel.*—There is now about 15,000 tons of this material in use on cars in the United States. In addition to the pieces already reported pressed steel shapes are now used for post pockets, side bearings, bolster-guide bars, bolster-guide blocks, stakes for gondola cars, corner bands, brake beams, door hoods, etc. In order to prevent too great a diversity of sizes of stake pockets it is suggested that the sizes at the top should vary by half inches, thus: 3 × 3½ ins., 3½ × 4 ins., etc, and that they have a uniform taper in each direction of ¼-in. in 6 ins.

The center plate, illustrated, is the form which has been used most extensively. It is preferred by manufacturers as the best form into which the steel can be pressed, and experience with this form on 25,000 cars is very satisfactory. The larger annular rib resists most of the thrust on the plate and prevents any shearing of the center pin. The bearing surface on the bolster is made as large as possible. Some pressed steel plates have been made with the bottom portion at the center raised from the bolster, so that the load is carried in suspension. The constant movement of the steel plate under the variations of load has already produced rupture in a number of such plates. For this reason, forms where the central portion has no bearing on the bolster (similar to Fig. 6 in our report of last year), are not recommended.

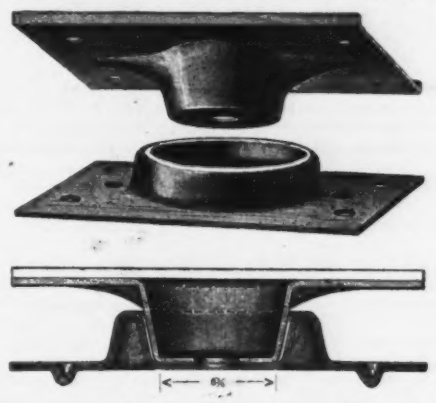
For cars of 60,000 lbs. capacity pressed steel center plates should be at least ½-in. thick.

The center plate, illustrated, is recommended as our standard form, so far as the bearing portion between center plates is concerned, leaving the width between flanges, height over all and spacing of bolts to be made to suit the bolsters on which they are used.

Pressed steel freight trucks are being gradually introduced in this country, and are now in service on a number of our roads. The weight is somewhat less than the diamond truck for 30-ton cars, and it is furnished at the same cost. The cost of material and labor in a diamond truck (exclusive of frame) is $80, and the pressed steel frame is supplied at $45 each, making the total cost of one pressed steel truck complete $125. The strength of these trucks is greater than the heaviest diamond truck now made. A shop near Chicago is now engaged in building steel freight cars, and they will soon have 25 or 30 metal cars in service.

A long discussion ensued over the recommendations of the committee as to the sizes of stake pockets, but they were finally approved, and it was voted that a committee be appointed to prepare drawings and models of standard stope pockets and center plates for wooden and iron transoms and report at the next Convention.

Malleable Iron.—We have nothing new to report about malleable castings in car work, except to call attention to the fact that, as the majority of M. C. B. standard couplers are now made of this material, we should have more information as to its strength and its behavior under the severe blows to which couplers are subjected. The shape of the arms and the lugs (or ears) of this coupler make it a very weak form for a buffer; it should, therefore, be made of a material having the greatest resistance to shocks. In preparing our report of last year we were unable to get from manufacturers any definite figures on the strength of malleable iron. The statements in that report relating



Recommended Standard Form of Pressed Steel Center Plate.

to the strength and resistance of malleable castings should be taken to apply only to thin sections ¼-in. or ⅝-in. thick.

The rules given for designing patterns for malleable castings state that "the strength of the casting depends very much upon the design, and that the *strongest* portion is the outside surface." "The strongest form is a star-shaped section. For brackets a *number of thin ribs* should be used instead of *one thick one.*"

A thin section being therefore necessary to secure superior strength in malleable castings, it seemed evident that in a casting like the M. C. B. coupler, 1 in. and 1¼ in. thick in the arms and lugs, we would not get the advantage of the high strength and ductility usually attributed to malleable iron.

This fact has such an important bearing upon the question whether malleable cast iron is the most economical material for the M. C. B. coupler, that we have made some investigation of the strength of malleable castings of various thicknesses, from ¼ in. up to 1½ in., increasing by eighths, and we present the results below.

The samples were obtained from the National Malleable Casting Co., Chicago, and were tested at the C., B. & Q. laboratory, at Aurora. We believe the results here given are the first published tests of the strength of malleable cast iron.

TENSILE TESTS OF MALLEABLE CASTINGS.

C., B. & Q. R. R., AURORA, Ill., May 20, 1891.

DIMENSIONS, INS.		Area, sq. in.	TENSILE STRENGTH, LBS.		Per cent. of elongation in 4 ins.	ELASTIC LIMIT, LBS	
Nominal.	Actual.		Actual.	Per sq. in.		Actual.	Per sq. in.
1⅛ × ¼	1.52 × .25	.38	13,200	34 700	2	8.000	21,100
1½ × ⅜	1.52 × .39	.593	20,000	33.700	2	9,000	15,200
1½ × ½	1.53 × .5	.765	25,100	32.800	2	13,000	17,000
1½ × ⅝	1.53 × .64	.979	31,400	32,100	2	19,000	19,400
2 × ¾	2. × .78	1.56	39,100	25,100	1½	24,000	15,400
1¾ × ⅞	1.54 × .88	1.355	45,500	33,600	1½	26,000	19,200
1 × 1	1.06 × 1.02	1.08	33,000	30.600	1	19,000	17,600
1¼ × 1¼	1 28 × 1.3	1.664	45,000	27,400	1	.....	.....
1½ × 1½	1.52 × 1.54	2.341	66,000	28,200	1½	.....	.....

While the results do not show any *regular* reduction of strength with increased thickness, yet it is plain that the average strength of the thin specimens is much greater than the thick ones. Thus the average strength of pieces ¼ in. thick up to ⅝ in., inclusive, is 33,000 lbs., and of the thick pieces, ¾ in. up to 1¼ ins., inclusive, only 28,980 lbs.—the thin specimen being 15% stronger than the thick ones.

But the most important fact brought out by these tests is the low ductility of malleable cast iron, whether *thick* or *thin*. The specimens ¼-in. and ⅜-in. thick had an elongation of only 2% in 4 ins., and those 1 in. and 1¼ ins. thick only 2% in 4 ins.

We can now give the tensile resistance and ductility of malleable cast iron, as compared with that of other metals suitable for those details of cars which are subject to severe blows. Current specifications for wrought iron require a strength of 50,000 lbs., and an elongation of 20% in 4 ins.; for good cast iron, 20,000 lbs.; for steel castings, 60 000 lbs. and 10% elongation in 4 ins.

COMPARATIVE TENSILE RESISTANCE AND DUCTILITY OF MALLEABLE CAST IRON AND OTHER METALS.

	Ultimate strength. Lbs. per sq. in.	Strength rank with cast iron as unity.	Per cent. of elongation in 4 ins.	Ductility rank, with malleable iron as unity.
Cast iron.....	20,000	1	0.35	....
Malleable cast iron.....	32,000	1.6	2.00	1
Wrought iron.....	50,000	2.5	20.00	10
Steel casting.....	60,000	3	10.00	5

WM. FORSYTH, JOHN MACKENZIE, E. D. BRONNER Committee.

WHEEL GUARANTEE.

It will be remembered that at the convention of 1889, at Saratoga, a plan was adopted for the purchase of chilled car wheels, the principal feature of which was that the wheels were not paid for outright, but were paid for according to the service obtained from them. Wheels removed from service on account of sharp flanges, flat spots, comby or shelled-out treads, cracked brackets or plates, and some other defects were to be replaced free of charge by the manufacturer, the failure being ascribed to faults in the making. For certain other defects, such as flat spots due to the brakes, and broken or chipped flanges not caused by defects in the casting, the railways were to stand the loss, it being due to the conditions of service.

A meeting of the Association of Manufacturers of Chilled Car Wheels was held in New York Nov. 21, 1889, and the position was taken that sharp flanges, flat spots, comby or shelled-out treads, cracked brackets or plates might be due to severe service as well as to defects in the manufacture. Hence it was proposed that wheels removed for these defects should be broken up, and if the depth and character of the chill and the strength of the metal were up to that called for by the standard specifications adopted by a joint committee of the Wheel Manufacturers and Master Car Builders, then the manufacturer should not be required to replace the wheel.

The point at issue between the two parties is a question of fact. Do the defects enumerated occur invariably from defects in the wheel, or may they happen to perfectly good wheels? The former view was the one taken by the committee, Messrs. J. J. Hennessy and Thomas Sutherland.

Sharp flanges may be due to variation in size of wheels on the same axle, to the trucks being out of square, or to one wheel wearing faster than the other. The first two causes, however, they considered of little importance, and held that the difference in the wearing qualities of wheels on the same axle was the cause of nearly all the sharp flanges. One of their principal reasons for believing that trucks out of square are not the cause of sharp flanges was that this cause would operate equally on both axles, and, as a matter of fact, one pair of wheels has often a badly worn flange, while the other pair is in good condition. For sharp flanges due to unequal wearing qualities of the wheels the wheelmakers should be held responsible. Hence the committee concluded that, unless mismating can be shown or the wheels are hot pressed on to an equal distance from the journal, the wheelmaker should replace wheels removed for sharp flanges.

For wheels worn through chill the committee thought the wheelmaker should also be held responsible, holding that the defect is due to an insufficient depth of chill. Comby and shelled-out treads the committee also believed to be due solely to the quality of the wheel. Cracked brackets or plates were said to be due to the brittleness of the iron or improper design. The committee acknowledged, however, that failures from cracked brackets and plates are most serious on roads having heavy grades, where brakes are kept hard on for long distances, thus heating and expanding the tread of the

wheel They believed, however, that for one wheel which fails in this service twenty will pass the ordeal successfully, and said that no encouragement should be given to wheelmakers to furnish wheels which cannot stand this service.

It was suggested that a compromise might possibly be arranged by the railroads assuming responsibility for half the failures from sharp flanges; but this they considered a more liberal concession to the wheelmakers than justice demands.

JOINT CAR INSPECTION.

After discussing various systems the committee recommended that at points where there is a large interchange of cars a system of joint inspection be established under the following plan:

Each road to hire its own inspectors, and to place them, in all matters pertaining to interchange of cars, in charge of a chief joint inspector, who shall be held entirely responsible for the inspection at that point. The inspectors to be subject to their respective car foreman to do repair or other work, when not inspecting for interchange.

The committee also submitted a form of joint inspection agreement, a code of rules to govern joint inspection, a form for weekly reports from joint inspection points, and a joint inspection defect card, all of which were proposed for adoption by letter ballot. The committee further recommended that at inspection points where there is one man for each road the inspectors should work together; also that a committee of seven be appointed to prepare a supplementary set of interpretations and illustrations of the M. C. B. rules of interchange and report at the next convention. The report was signed by Messrs. A. M. Wartt, H. C. McCarty, H. Middleton, Wm. Garstong and Samuel Irvin.

AIR-BRAKE STANDARDS AND INSPECTION AND LEASE OF AIR BRAKES ON FREIGHT CARS.

This report was prepared by a joint committee, consisting of Messrs. Blackall, Stevens and Clarke, from the Master Mechanics' Association, and J. S. Lents, Wm. Turreff and N. W. Sample, from the Master Car Builders' Association. To ascertain to what extent the standards already adopted by the Association had come into use the committee sent out a circular of inquiry, the replies to which are summarized in the following table:

Name of road.	No. of freight cars with M. C. B. brake gear.	No. of freight cars with M. C. B. brake gear and iron brakebeams.	No. of freight cars with iron brakebeams and other brake gear than M. C. B.	Can good results be secured with the use of wooden brakebeams?	Is an iron beam necessary to secure the best results?
Mich. Cent.	600	600	.....	No	Yes
C., C., C. & St. L.	1,600	1,100	.....	No	Yes
Ohio & Miss.	.....	.....	1,471	No	Yes
B. & A.	300	300	.....	No	Yes
B., C. R. & N.	.....	.....	200	No	Yes
D., S. Sh. & Atl.	23	.....	.....	Yes	No
Pa. Co.	4,522	3,000	.....	No	Yes
N. P.	6,500	.....	.....	No	Yes
B. & O.	500	500	.....	No	Yes
C., B. & Q.	4,498	4,498	.....	No	Yes
C. & O.	1,600	1,000	.....	Yes	Yes
L. S. & M. So.	200	200	.....	Yes	No
C., B. & N.	.....	.....	1,500	No	Yes
Wabash	500	.....	.....	Yes	No
U. P.	3,065	.....	.....	No	Yes
C. & W. M.	200	200	.....	No	Yes
K. C., Ft. S. & M.	400	400	250	Yes	No
St. L., A. & T. H.	.....	.....	80	No	Yes
H. & Tex. Ctl.	550	.....	.....	Yes	No
P. & R.	141	.....	.....	No	Yes
Cent. Vt.	850	.....	.....	Yes	Yes
Int. & Grt. N.	.....	.....	1,400	No	Yes
D. & R. G.	.....	.....	102	Yes	No
Chi. & Alton	450	450	25	No	Yes
C., R. I. & P.	3,000	3,000	.....	No	Yes
R. & D.	3,478	2,971	.....	No	Yes
C., M. & St. P.	1,413	1,413	150	Yes	Yes
Pa. Co. (S. W. Sys.)	1,452	1,452	.....	No	Yes
Lehigh Valley	2,500	.....	.....	No	Yes
	38,342	21,084	5,178		

It appears from this that from the time of the adoption of a standard for air-brake rigging, in the fall of 1889, up to March 1, 1891, the roads named in the above table have applied the air brake with the standard brake rigging to 38,342 freight cars, of which 21,084 had metallic brakebeams. The committee found no reason for altering the standards already adopted. There are, however, two errors in the drawings in the published standard drawings. The brake staff is put on the wrong side of the car and the distance from the lower end of the dummy-coupling bracket to the center or the hole is 1½ ins. instead of 2¼ ins. The committee urges the use of metallic brake-

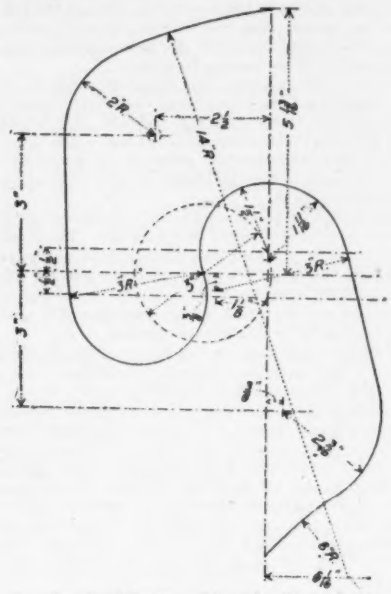


Fig. 1. Standard Contour Lines for M. C. B. Coupler.

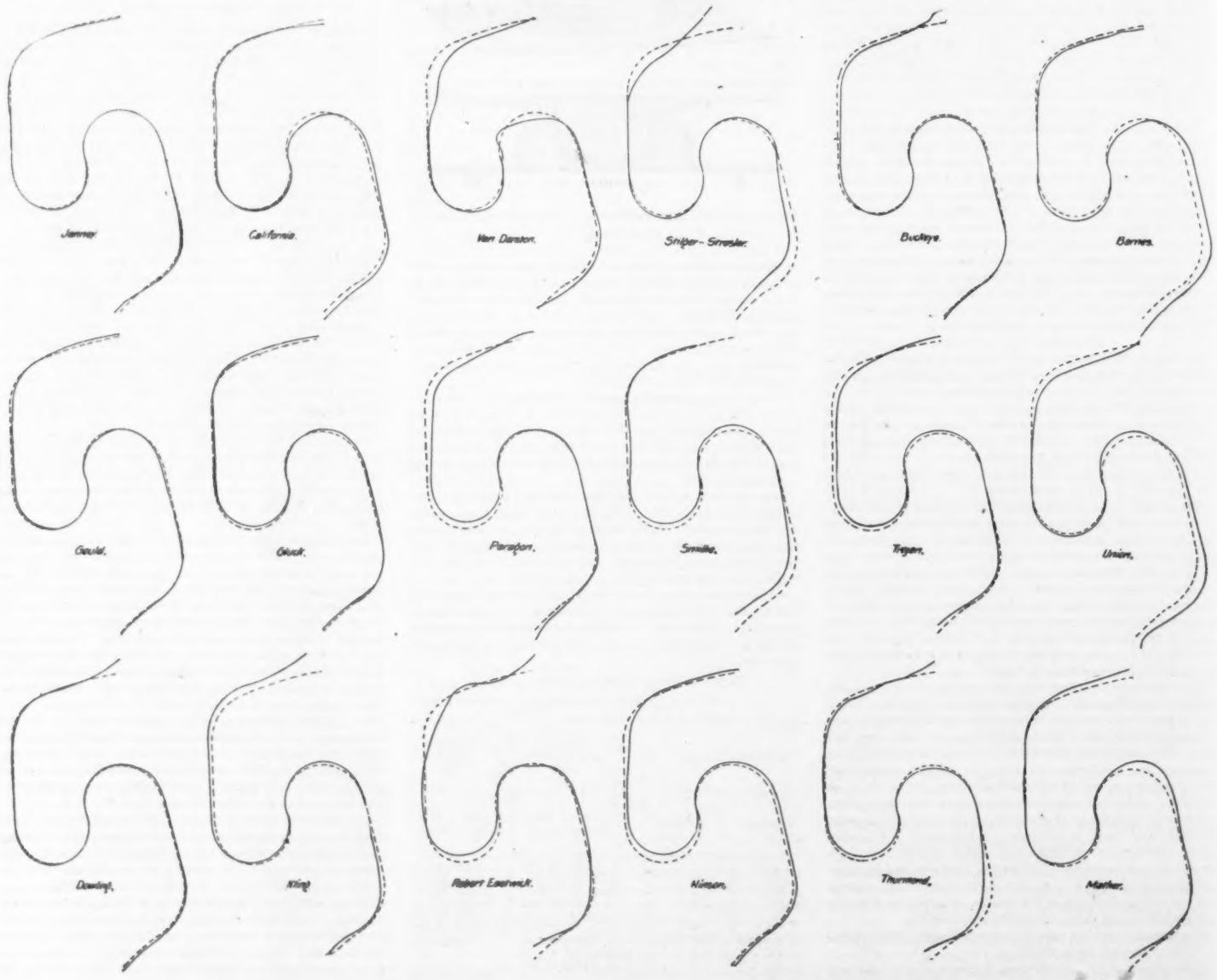


FIG. 2. VARIATION FROM THE STANDARD CONTOUR LINES IN DIFFERENT MAKES OF M. C. B. COUPLER.

beams in place of wood in all cases where air brakes are applied.

In considering the care and maintenance of air brakes the first essential seemed to be to establish a uniform system. To secure this result the committee prepared a code of rules containing instructions to enginemen, trainmen, engine-house foremen and car inspectors, forming a pamphlet of 32 pages. It was recommended that this be printed and sold to the railways by the Association in the same way that the rules of interchange are. On the instructions of this book it was recommended that every employee be examined.

The committee proposed for adoption the following amendments to the rules of interchange:

In delivering freight cars equipped with air brakes at interchange points the air-brake apparatus must be in good working order, and any car may be rejected by the receiving road if the air brake apparatus upon it is defective in any respect. To determine whether the air-brake apparatus is in good order its operation must be tested under the full working air pressure of 70 lbs. per sq. in. at the delivery point, by the delivering road, and under the supervision of or to the satisfaction of the inspector of the receiving road.

The conditions constituting good order shall be as follows:

(1) The cylinder must have been cleaned and the triple valve cleaned and oiled within six months, and the date of the last cleaning and oiling marked upon the brake cylinder.

(2) The cylinder must have been oiled within three months, and the date of the last oiling be marked upon the cylinder.

(3) The brake shoe slack must be so adjusted that under the full application of the brake the piston travels not less than 4 ins. nor more than 8 ins.

(4) The brake must apply and release promptly with proper handling by the engineer's valve.

(5) The triple valve and auxiliary reservoir must be free from water.

(6) The air pipes and all connections thereto must be free from leaks, and the pipes properly secured to the car body so that injury shall not occur to the apparatus, car body nor leaks be produced by shaking and vibration of the pipe.

(7) The air brake hose, when not coupled with that of another car, must be properly secured in the dummy coupling.

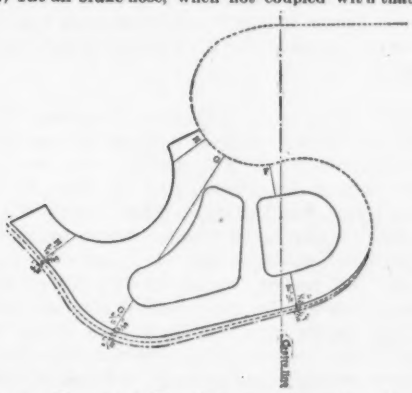


Fig. 3. Proposed Template for Measuring Contour Lines of M. C. B. Coupler.

(8) The brake shoes must all be at least ⅝ in. thick at the center.

(9) All parts of the brake rigging must be sound and efficient, and in accordance with Rule 3, Section S, of the M. C. B. Code.

A car having a defect in the brake apparatus may be received with a defect card for the same, provided that the defect be of such a nature that it shall not interfere with the operation of the hand brake upon that car, nor with the operation of the air brake upon any other car of the train.

The committee did not attempt to decide whether air brake testing should be done by a stationary plant or by the switching locomotives, but suggested that the latter appears to be the more feasible plan. The committee believed that no charges should be made against the owner of the car for cleaning and oiling the brake cylinder and triple valve and taking up the slack in the brake gear connections; the only charge made against the owner should be for the replacing of brake shoes worn beyond the limit above specified.

MAINTENANCE OF THE STANDARDS OF THE ASSOCIATION FOR COUPLERS OF THE M. C. B. TYPE.

At the convention of 1890 a resolution was adopted instructing the Executive Committee to ascertain whether the M. C. B. coupler as now furnished by various manufacturers conforms to the standards of the Association. A sub committee was appointed, and solicited from each manufacturer of M. C. B. couplers a sample coupler with drawings. The accompanying engravings show the contour lines of each sample coupler received, the standard M. C. B. lines being shown on each in dotted lines.

The committee recommended that a maximum and minimum limit be established for the several parts of rough coupler castings.

The committee submitted templates and gages for determining the departure of couplers from the standard. Fig. 2 shows the template for contour lines with the variation permissible at various points. Fig. 3 shows a gage to determine all other measurements of the M. C. B. coupler.

The Executive Committee recommended that these gages be used by the Association.

JOURNAL BOX, BEARING, WEDGE AND LID FOR 60,000 LB. CARS.

Last year's attempt to adopt a standard journal box, etc., for 60,000-lb. cars was defeated on letter ballot by a vote of 299 to 249. The Executive Committee believed this to have been due chiefly to a difference of opinion regarding the lid, which was of the Fletcher type. The committee therefore submitted the same box, bearing and wedge for adoption this year, substituting for the Fletcher lid the lid shown in the accompanying drawing. This lid may be made either of malleable iron or pressed steel. The report and drawings submitted last year may be found on page 570 of our issue of June 14, 1890.

STEAM-HEATING AND VENTILATION OF PASSENGER CARS.

The report of the committee, consisting of Messrs. J. M. Barr, T. A. Bissell, J. W. Marden, J. C. Parber, and W. H. Lewis, reviewed the different systems of heating, and stated that, while direct steam was undoubtedly the cheapest and easiest applied, it was not satisfactory on account of the difficulty of regulation, over-heating of the car, and the excessive temperature of the pipes, which in some cases within the committee's knowledge had burned shoes and traveling bags. Several systems of hot-water heating were described.

The following recommendations were made by the committee:

1. That all pipe be placed so far as possible inside the car.

2. That a uniform location be adopted for the ends of the train pipe.

3. That a standard form of connection be adopted between the coupling ties and the train pipe.

4. That means for heating cars independently should be retained. These recommendations were approved by the Convention, and the committee was continued with instructions to report the standards proposed above for action at the next Convention.

WEDNESDAY, JUNE 10.—Rules of Interchange.

On request Mr. F. D. Adams was excused from service on the committee to report subjects for next meeting. After a little discussion the decisions of the Arbitration Committee were approved. The Rules of Interchange were then taken up and the recommendations of the Arbitration Committee were considered in detail. The most important change made was the adoption of a series of rules covering the care of air-brake on cars which are substantially the same as those recommended by the Committee on Air-Brake Standards below, except that the brake cylinder and the triple valve are only required to be cleaned once in 12 months. There was much discussion and opposition, but the new rules were adopted by a substantial majority. It was also voted without opposition that defective M. C. B. drawbars should be accepted in interchange only when the defects were such minor ones as did not interfere with their efficiency and safety.

After some further minor changes, a resolution was introduced by Mr. WAITT, of the Lake Shore, proposing a number of important additions to the defects for which the owner should be responsible. After considerable discussion the matter was referred to the Arbitration Committee for action, with instructions to report on Thursday morning, and adjournment was then taken.

The following are abstracts of the committee reports presented at later sessions of the convention.

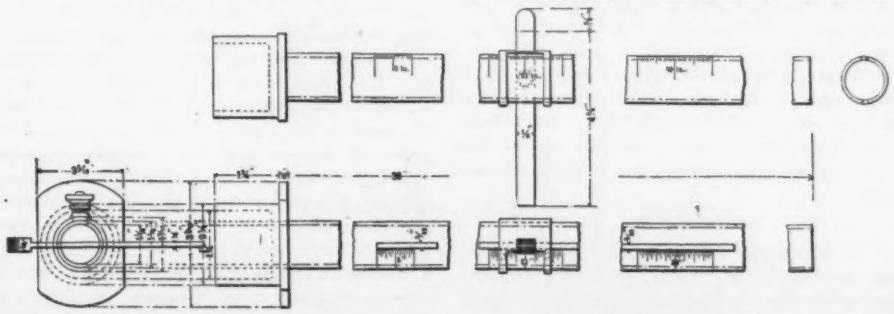
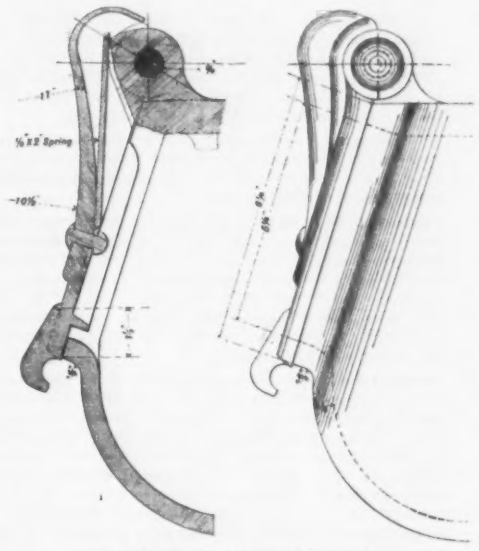


FIG. 4. PROPOSED GAGE FOR MEASURING LENGTH AND OTHER DIMENSIONS OF M. C. B. COUPLERS.

EXHIBIT AT THE CONVENTION.

The temporary building which the proprietor of the Stockton Hotel agreed to erect to accommodate the exhibits of the railway supply firms attending the Convention proved to be a somewhat dilapidated tent. It was well filled, however, and many other exhibitors occupied rooms in the hotel, or even set up their appliances in the road. The greatest display was in car couplers. It might have been supposed that the rapid progress of the M. C. B. standard type during the past year would have damenped the ardor of the automatic link-and-pin men; but it is a case of blissful ignorance with this class of inventors as a rule. No less than ten exhibitors of this class were on the ground, each of them touchingly confident that his device was the long-sought solution to the car-coupling problem. But the makers of the M.C. B. couplers were there in full force, the patentees of new styles making the bravest showing. The couplers shown were the Janney, Gould, Dowling, Van Dorston, Thurmond, Hinson, Robert-East-



M. C. B. Standard Journal Box Lid.

wick, Trojan, Buckeye, Smillie, Eureka, Barnes, Perfection, Bowler, Mather, Drexel and Stilger-Strosler, making 17 in all.

Perhaps the car-heating exhibits were the next most prominent, headed easily by the Consolidated Company's system, which was admirably shown by working models, with glass tubes in which the circulation of the steam and water could be readily watched. Mr. J. F. MCELROY, to whose ingenuity many of the successes of the company are due, was in charge of the exhibit. The exhibit of next prominence was that made by the Morton Safety Heating Co., which adopts a system of storing the heat in earthenware pipes. The Safety Car-Heating and Lighting Co., the Gold Car Heating Co. and the Erie Car Heating Co. showed their apparatus, and the Martin Co. showed their new temperature regulator and their hose coupling. The Roberts metallic pipe coupling and the Curley & Bailey meltallic pipe coupling were other exhibits in the car-heating class.

Car seats were as usual one of the most attractive exhibits for more reasons than one. Hale & Kilburn, the Wakefield Rattan Co., H. A. Wheeler and the Roberts woven-wire seat were among the goods and firms represented.

The other exhibits in the passenger car department were the King car-window support and the Pancoast ventilator.

In brakes the largest exhibit was made by the Boyden Co., which showed a full-size consolidation engine brake in working order. Smaller exhibits were made by the Westinghouse Co. and the New York Air Brake Co.

In metals there were fine exhibits by the Pencoyd Iron Co. and the Schoen Mfg. Co. The American Steel Wheel Co., of Boston, showed a number of all-steel wheels, and in metal brake beams the "Central" and the "Universal," were shown.

The other exhibits and exhibitors were as follows: Chicago grain door; Moore car door; Harless Flush car door; Chalmers Spence Co., asbestos woods; Peerless Rubber Mfg. Co., rubber goods; Standard Paint Co., P. & B., paints and paper; Field feed-water purifier, attached to a large boiler; Litofuge Mfg. Co., boiler compound; Dreher's car-axle grease; Smith's car-journal oiler; Ashcroft Mfg. Co.; Crosby Steam Gage & Valve Co.; Detroit Lubricator Co.; Dudgeon hydraulic jacks; Robie ball-bearing screw jacks; Norwood car replacer; Tilden replacing frogs; Hubbard anti-friction outer bolster bearings; Lappin brake-shoe; Wells light; Butler draw-bar attachment; Damascus Bronze Co.; Davis Spring Plate Co.; the Boyer speed recorder, Fox Solid Pressed Steel Co., H. W. Johns Mfg. Co., C. B. Hutchins & Sons, Knitted Mattress Co., Page Belting Co., Scarritt Furniture Co., and Schutler Mfg. Co., double acting drill,

ENGINEERING NEWS

AND

AMERICAN RAILWAY JOURNAL.

Published Weekly at Tribune Building, New York.

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D. McN. STAUFFER, A. M. WELLINGTON.....EDITORS
CHAS. W. BAKER, E. E. R. TRATMAN, M. N. BAKER, F. P. BURT, } ASSOCIATE EDITORS
GEO. H. FROST.....BUSINESS MANAGER

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Advertising rates, 20 cents per line *agate measure. Schedule sent on request.* **Changes** *of advertisements must be in hand on Tuesday afternoon;* **New** *advertisements Wednesday afternoon;* **Transient** *advertisements not later than Thursday noon. The last pages go to press early on Friday, and we shall be obliged if subscribers who fail to receive their papers promptly will notify us without delay.*

Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty, or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

COMING TECHNICAL MEETINGS.

Engineers' Club of Philadelphia.—June 20. Secy., Howard Murphy, 1122 Girard St.

Engineers' Club of Kansas City.—July 13. Rooms, Baird Building. Secy., H. Goldmark.

Civil Engineers' Club of Cleveland.—July 14. Secy., A. H. Porter, 50 Euclid Ave.

Rensselaer Society of Engineers.—June 17. Annual meeting, Troy, N. Y. Secy., T. J. Foster.

Denver Society of Civil Engineers.—July 28. "Canals and Irrigation." Secy., Geo. H. Angell.

Civil Engineers' Association of Kansas.—July 8. Secy., J. C. Herring, Wichita, Kan.

Engineering Association of the South.—July 9. Secy., Olin H. Landreth, Vanderbilt University, Nashville, Tenn.

American Railway Master Mechanics' Association.—June 16. Annual Convention, Cape May, N. J.

Engineers' Society of Western Pennsylvania.—June 16. Secy., J. H. Harlow, Pittsburg, Pa.

International Association of Car Accountants.—June 16, 17. Annual Meeting at Denver. Secy. S. P. Sechrist, 92 Pine street, New York.

American Society of Mechanical Engineers.—June 18–20. Annual Convention, Providence, R. I. Secy., F. R. Hutton, 12 West Thirty first street, New York.

Engineers' Club of St. Louis.—June 17. Secy., Arthur Thatcher, Room 801, Odd Fellows' building.

Boston Society of Civil Engineers.—June 17. Secy., S. E. Tinkham.

Association of Railway Telegraph Superintendents.—June 17. Annual meeting at Cincinnati, O., Grand Hotel.

Engineers' Club of Cincinnati.—June 18 Secy., J. F. Wilson.

Western Society of Engineers.—July 1. Secy., J. W. Weston, 280 La Salle St., Chicago.

Engineers' Club of Minneapolis.—July 2. Rooms, Public Library Bldg. Secy., F. W. Cappelen.

Association of Civil Engineers of Dallas.—July 3. Secy., E. K. Smoot, 803 Commerce St.

Technical Society of the Pacific Coast.—July 4. Secy., O. von Geldern, 819 Market St., San Francisco.

Civil Engineers' Society of St. Paul.—July 6. Secy., C. L. Annan.

OUR business office respectfully but earnestly requests a discontinuance of the use of postage stamps for currency during the Summer months, except for very small amounts. It is usually just as easy and safe to inclose a dollar bill as the equivalent amount in stamps. But it is not so easy for our clerks to use stamps firmly glued together in sheets four deep. Have mercy on the clerks, and during the hot season do not impose further wear and tear upon their moral makeup.

THE affairs of the proposed International Engineering Congress at the World's Columbian Exposition of 1893 are in the hands of men who are prominent as engineers and active as business men, and well calculated to push them to a successful issue. At the Chicago meeting on the general committee of engineering societies, on May 15, a permanent organization was effected, with OCTAVE CHANUTE, President of the American Society of Civil Engineers, made President of this permanent general committee of Engineering Societies, Columbian Exposition, and E. L. CORTHELL elected Chairman of the executive committee of the same. The directory of the Exposition is in full sympathy with the proposed movement, and at the meeting referred to the Hon. C. C. BONNEY, President of the World's Congress Auxiliary of the Exposition, promised every aid and assistance possible in furthering the objects of such an engineering congress, and he dwelt at length upon its importance among the various congresses proposed. As stated in the report on organization, these objects are to provide an engineering headquarters at Chicago for members of all the engineering societies in the world, and especially to promote the holding of an International Engineering Congress in 1893. The committee also resolved that the importance of engineering entitled it to an independent department among the world's congresses to be held in Chicago.

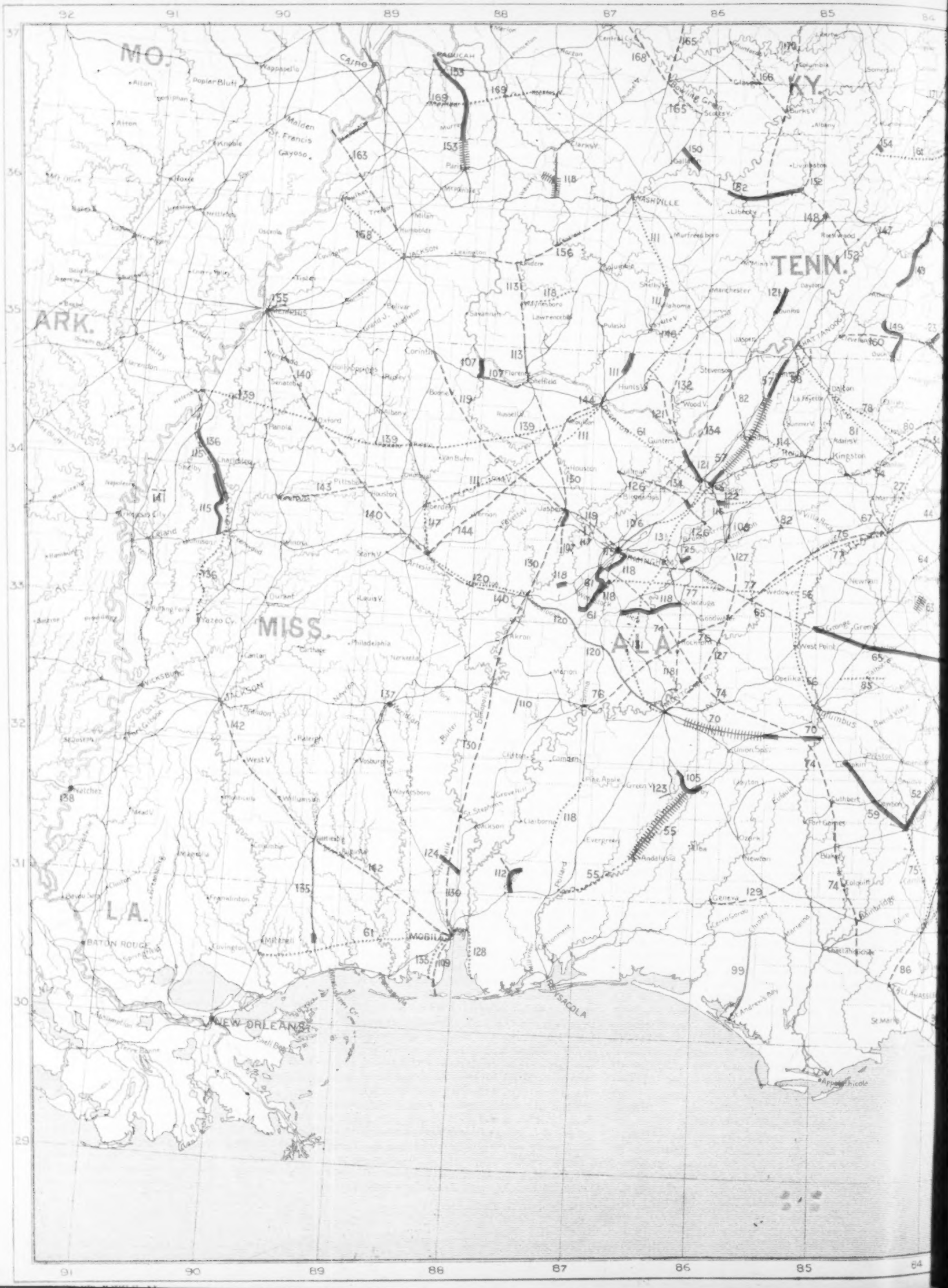
THE notable feature in this movement is that engineering is to have a congress of its own, and is no longer to be simply regarded as an adjunct to other and older scientific departments. This proposition cannot be considered as an accidental event, brought about by the exertions of a few engineers more ambitious and more energetic than the rest. It is practically a demand of the time we live in; and is only possible because the department of engineering has worked such vast changes on the face of mother earth, and has entered so fully into our every day life, that all men now recognize its power, and stand ready to do it distinct honor. While such a congress of the world's best engineers would hardly be called upon to solve any special engineering problem, yet the fact that the occasion should and doubtless will call for the production of their latest and best work, and bring them into contact with each other for formal and informal discussion, is in itself of great value and likely to result in still more rapid advancement in the engineering arts. It is an opportunity that should not be lost by the engineers of the United States, and it is for them to see that the matter presented is worthy of their country and their profession.

A CORRESPONDENT writes us that the city of Atlanta, Ga., requires engineers and surveyors practicing within the city limits to pay a license fee of $25 per annum; and the question is put as to the custom of other cities in this respect. We must confess that the license plan is new to us. Many cities require engineers and surveyors to give a bond of, say, $2,500, with three sureties. This enactment is supposed to protect citizens against careless work on the part of the surveyors; but why engineers should be taxed or put under bond, and architects, physicians or even lawyers omitted in this protective measure, we cannot say. The three professions last named can certainly do as much mischief as the engineer or surveyor; and when harm does result from the ignorance or inattention of these three classes it is usually of a more serious nature than a slight blunder in locating a corner stake on a city lot, bad as the latter may be when building lines are in question. If it is the purpose of the city of Atlanta to raise revenue, all professions should be taxed in proportion to their power for doing material harm to the citizens. If the intention is to exclude those unfitted for practice by demanding a license fee, the fee named is absurdly small, and the law is simply oppressive and without resultant benefit to the citizens.

We would heartily approve of any method which would insure the competency of all practicing engineers and surveyors, and have no doubt but that the list of men who style themselves such and attempt to practice would stand a thorough weeding out with benefit to the general community. But a license fee, of almost any proportion, will not keep out the pretender; and even a heavy bond is not a sure guarantee of fitness for office. A much more sensible plan would be to require engineers desiring to practice in any town or city to first pass an examination before a properly appointed and efficient board of two or three older engineers. Until they had passed such an examination they should not be entitled to recognition or their work to legal acceptance within the city lines. A fee might be justly charged for this examination and a warrant of competency, for in such a case the engineer would receive something of value to him for his expenditure. Unless the movement should be a common one, however, throughout a considerable section of the country, the method suggested would have its difficulties in the organization of a satisfactory board of examining engineers; for local preferences and jealousies should not be permitted to enter into the composition of such a body. But even on present lines the plan would work better and be more generally useful than the exaction from a special class of a small license fee which does not protect any one.

EXTENDED legal difficulties regarding both water-works and sewerage systems are imminent at Plainfield, N. J. The situation was reviewed editorially in this journal May 16, 1891. As was then stated, the Plainfield Water Supply Co. is building works under a state charter granted in 1869, which antedates the city charter by three years. Six against five of the City Council have tried to prevent the above-named company from completing its work, and have been defeated in court, their intention being to grant a franchise for both water-works and sewerage to Mr. J. M. LOW, of Kingston, N. Y.

Notwithstanding the opposition of five of the council and the citizens generally, including the heaviest taxpayers, on June 6, the "combine" of six granted a franchise for a sewerage system to Mr. LOW and another for water-works to the Plainfield Aqueduct Co., of which we understand Mr. LOW is the head. Under the laws of New Jersey it is necessary for a sewerage company to purify sewage before discharging it into a stream or pond. The people have, therefore, been doubly anxious to know what kind of a sewerage system was to be built, and to have the plans approved by a competent engineer before adoption. But not even the opposition in the council have had a fair chance to so much as inspect the sewerage plans and ordinance. The people want sewers, but are opposed to such an unusual procedure as having them built by a private company. The Plainfield Water Supply Co., whose works are well under construction, offer hydrants at an annual rental of $15, while the franchise of the new company provides for a $25 rental. Undoubtedly the LOW franchises will be fought in the courts. In view of the fact that the Corporation Counsel, who drew the franchises, is opposed to them; that a street railway franchise granted by the "combine" has been declared in court to be void, and that the court refused to allow the injunction brought by the "combine" against the Water Supply Co.—in view of all these facts and the opposition which prevails throughout the city it seems probable that good judgment will finally prevail and that the city will be left to construct and operate its sewers, which it is well able to do, and that the Plainfield Water Supply Co. will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Tullahoma
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Dalton
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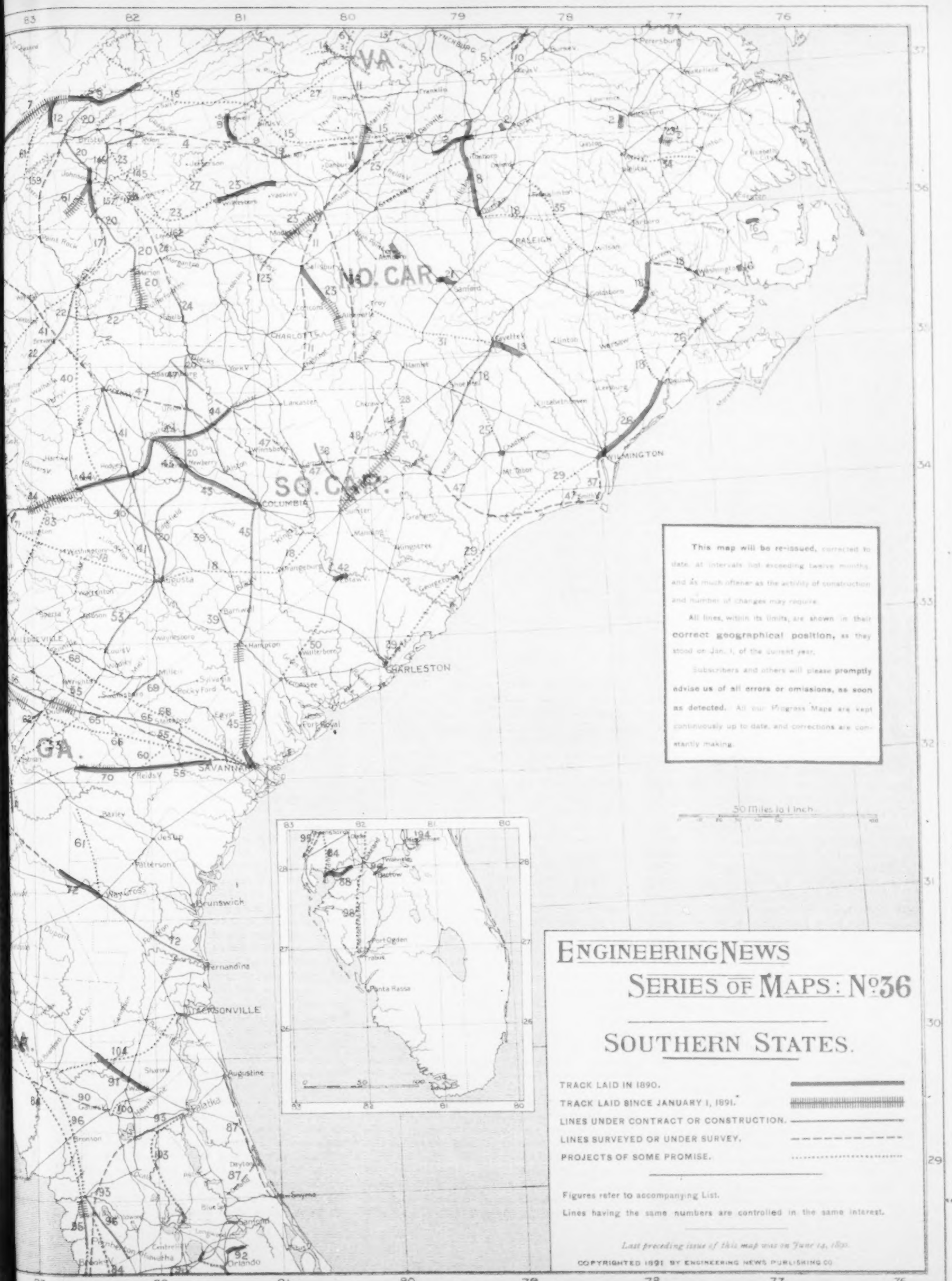

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ENGINEERING NEWS
SERIES OF MAPS: No. 36

SOUTHERN STATES.

TRACK LAID IN 1890.

TRACK LAID SINCE JANUARY 1, 1891.

LINES UNDER CONTRACT OR CONSTRUCTION.

LINES SURVEYED OR UNDER SURVEY.

PROJECTS OF SOME PROMISE.

Figures refer to accompanying List.

Lines having the same numbers are controlled in the same interest.

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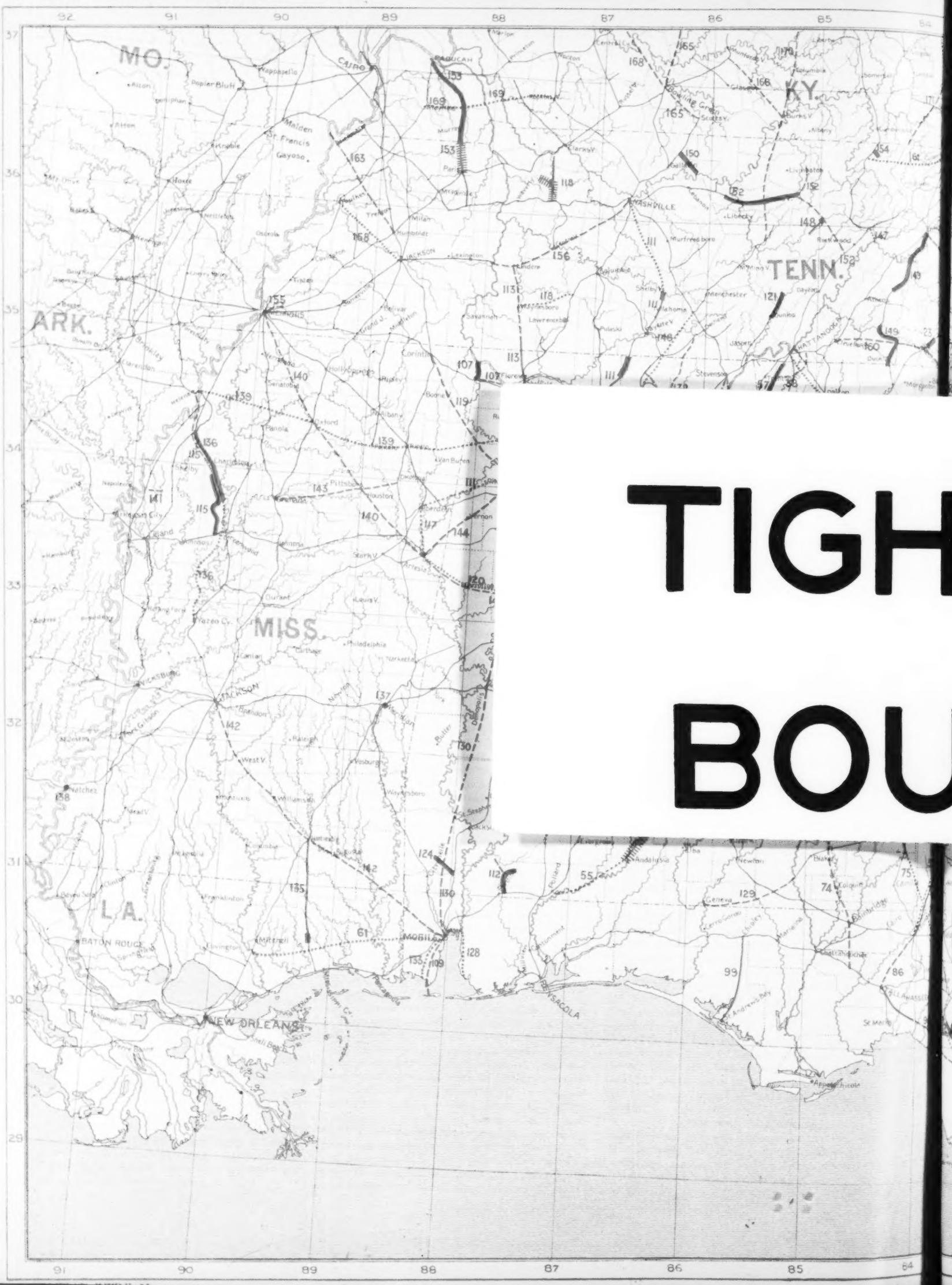
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Chattanooga
Tuscumbia
Corinth
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Oxford
Panola
Pittsboro
Houston
Starkville
Meridian
Brandon
Raleigh
Vicksburg
Natchez
Tallulah
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Bainbridge
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Apalachicola
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Lake Pontchartrain
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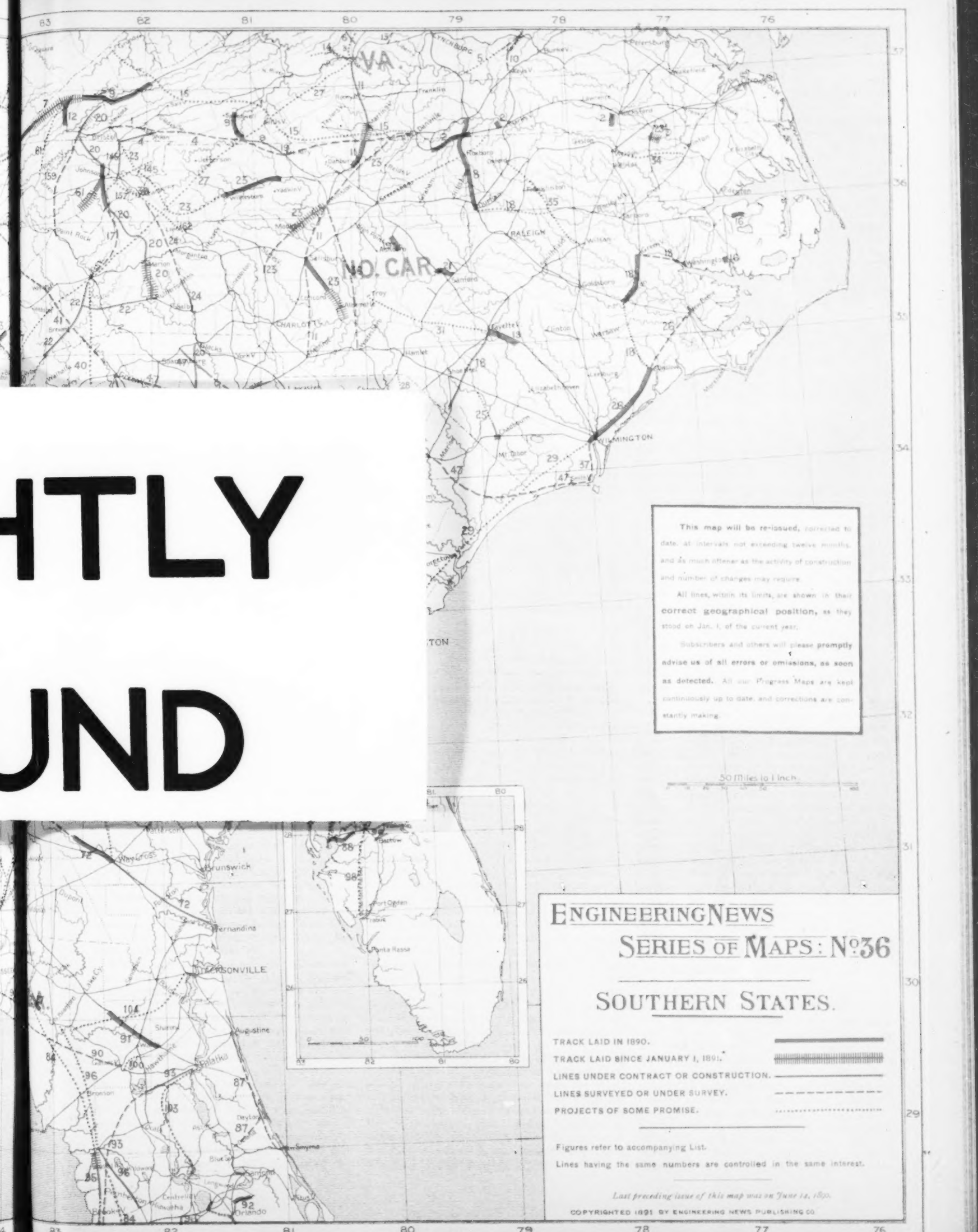

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ENGINEERING NEWS SERIES OF MAPS: No. 36

SOUTHERN STATES.

TRACK LAID IN 1890.

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LINES UNDER CONTRACT OR CONSTRUCTION.

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eventually have the field to itself. In the meantime we advise capitalists and sub-contractors, dealers in supplies and in labor of the anomalous condition of affairs in Plainfield, which demands their careful investigation before investing in any part of the new enterprise.

Railway Construction in the South.

We present with this issue of ENGINEERING NEWS our annual map and statistics showing the progress and prospects of railway construction in the states lying south of the Ohio and east of the Mississippi Rivers. The summary of the mileage in the various stages of construction in the several states is as follows:

States.	Track laid.		Under contract or construction.	Located and under survey.	Projects of some promise.
	1890.	To date in 1891.			
W. Virginia...	95 5	75	305	161	328
Virginia	212.75	77	290	39:	813
N. Carolina..	288.79	80	354	659	736
S. Carolina.. .	171.00	68	478	406	316
Georgia	372.34	120	509	885	1.547
Florida.....	78.84	9	190	409	636
Alabama	257 99	118	211	1,500	798
Missis-ippi . ..	86.80	...	51	491	338
Tennessee . ..	187.40	45	222	554	356
Kentucky.....	198.00	...	33	520	465
Total.....	1,952.41	592	2.553	5,978	6,253

Comparing these totals with those published with our last preceding map of this section, we have the following results at the dates named:

	Track laid. Year previous.	Track laid. Portion of year to date.	Under construction.	Under survey.	Projected.
June 14, 1890....	1,756	802	2,892	5,147	7,450
June 13, 1891....	1,952	592	2,553	5,978	6,353
Inc. or dec., 1891	+196	—210	—249	+831	—1,097
Inc. or dec., per cent	+11.16	—26 18	—8.88	+16.14	—14.72

From this it is seen that there has been a considerable decrease, both in the mileage under construction and completed this year and in the mileage projected with some prospects of being placed under construction in the near future. On the other hand, the mileage upon which surveys are completed or in progress is larger than it was one year ago. The comparisons thus indicate that, taking the territory as a whole, about as much work is projected for the next two or three years as there was a year ago, but that there will be a falling off in the current year's construction. In order to make a just comparison, however, it is necessary to study the lines somewhat in detail.

An inspection of our detailed list will show that not only is there less mileage under construction now than there was at the same date a year ago, but that of the mileage under construction at the respective dates a smaller proportion is now being actively pushed than at that time. Several of the more important companies have largely discontinued work on their various extensions, and others are progressing only in a slow way. Active construction is confined to the extensions of the older companies, or of companies which had completed their financial arrangements before the financial disturbances of last fall.

On the other hand, it will be seen upon an examination of our map that the relative positions of the centers of greatest activity have changed but little. The majority of the lines penetrate the mineral regions or form seaboard connections for lines which do. The larger number of these pass through rich and undeveloped sections of the country and will supply needed facilities, and their construction is in many cases only a matter of time. Moreover, it is to be remembered that the present figures are compared with those of a year in which the industrial activity was unusually great, and during which more miles of railway were constructed than at any time since 1887.

Taking the work as a whole, it is probable that the decrease is due more to the stringency of the money market than to a lack of opportunity for the profitable construction of railway lines. While money can be secured on call or short time, long-time loans are difficult to obtain. This necessarily effects railway construction more than most other industries. At the same time the tendency to build lines to develop prospective "commercial centers" has been especially prominent in the section of country under consideration, and the financial stringency will do good work in weeding out these wild-cat enterprises. Railways can profitably be constructed in many sections of the South, and probably will be constructed, but experience with railway "booms" in other sections of the country should teach us that none such are wanted here.

Considering the work by states, it is seen that Georgia leads both in mileage completed and under construction this year and in the mileage projected for future construction. Alabama, North Carolina and Virginia follow Georgia in the order named, each having a large mileage under way. Work is also quite active in Tennessee. West Virginia and Kentucky lie wholly or partly outside the limits of our map, and were considered in connection with our map showing construction in the states east of Chicago, published April 12. They belong, however, to the South in the nature of their development, and are thus included in our totals.

An inspection of the map will show that the various projected lines may be roughly divided into two classes. The first includes lines projected in and around the mineral regions, and intended largely to develop the local traffic, and the second lines, generally longer, intended to form seaboard connections for the first. The lines under way in central and northern Alabama, and eastern Tennessee, and in western Virginia and North Carolina belong to the first class, and those in South Carolina, Georgia, and, to a less extent, Florida, to the second.

Work in Virginia and North Carolina is confined largely to the western sections of those states. Both the Norfolk & Western and the Richmond & Danville systems have completed or are building short branches to develop the local traffic. The former company has completed an important connection with the Cumberland Valley Branch of the Louisville & Nashville R. R. in western Virginia and has under way a line to connect with the northern extension of the Cape Fear & Yadkin Valley R. R. at the North Carolina line. The Richmond & Danville has nearly completed its western North Carolina Branch to a connection with the Marietta & North Georgia R. R. at Murphy, N. C., and has a line well under way between Danville, Va., and Mooresville, N. C., and another projected to Bristol, Tenn. Among the other more noticeable lines in this section are the French Broad Valley R. R., the Ashville & Bristol R. R., the Bristol, Elizabethtown & North Carolina R. R., penetrating the Cranberry mineral district, and the Danville & East Tennessee R.R. and the Virginia & Kentucky R. R., projected from Danville, Va., west to connections with Northern roads at the Tennessee and Kentucky lines. The Charleston, Cincinnati & Chicago R. R. has completed a short extension in North Carolina this season and has lines partly completed between Marion, N. C., and Minneapolis, Va., and Blacks, N. C., and Augusta, Ga. The road is now in the hands of a receiver, and efforts are being made to secure the construction of the uncompleted links.

In South Carolina the Charleston, Sumter & Northern and the South Bound companies are actively pushing work on their respective lines, and the old Carolina, Cumberland Gap & Chicago R. R. has begun work on an extension from Edgefield to Abbeville. The Carolina, Knoxville & Western R. R. Co., which has a partly graded line from Augusta, Ga., to Knoxville, Tenn., has been placed in the hands of a receiver.

The most important lines under way in Georgia are the Macon & Atlantic, the Macon, Dublin & Savannah, and the Georgia, Carolina & Northern. The first is being built by the Georgia Construction Co., which built the Georgia Southern & Florida R. R., and the Macon & Birmingham R. R. The company is now in financial difficulties and work is progressing only in a slow way. It is expected, however, that arrangements will be completed shortly whereby construction will be actively pushed. The Macon, Dublin & Savannah is a rival line between the same points. It is now nearly completed from Macon to Dublin, 54 miles, but little work has been done towards the extension to Savannah. The Georgia, Carolina & Northern R. R. completed a long stretch of track across South Carolina last year and is now vigorously pushing construction between the Savannah River and Atlanta. It is being built in the interest of the Seaboard Air Line, and, when completed, will furnish that system a Western connection with roads centering at Atlanta. Among the other more important lines are the Middle Georgia & Atlantic, the Augusta & West Florida and the Georgia Southern & Florida extension from Tifton to Thomasville.

The Savannah, Americus & Montgomery, the Central R. R. of Georgia and the Chattanooga Southern have each completed a long stretch of track in Alabama this season, and the Montgomery, Tuscaloosa & Memphis is slowly pushing work on its line from Montgomery to Tuscaloosa. The other work is confined to the northern and eastern portions of the state, and consists mainly in short lines penetrating the mineral regions tributary to Birmingham.

In Florida there is a considerable amount of work in progress in the central and western portions of the state. The lines are sufficiently described in the detailed list. Construction in Mississippi is confined to the extension of the Gulf & Chicago R. R. to Hattiesburg. Of the lines surveyed the Mobile, Jackson & Kansas City, the Nashville & Mississippi Delta and the Memphis & Atlantic are the most important. There is but little prospect of work being begun on any of these this season.

The more important lines under way in Tennessee are the Paducah, Tennessee & Alabama, the Tennessee Midland, the Decatur, Chesapeake & New Orleans and the Nashville & Knoxville. The first named has laid a short stretch of track this year and is pushing work on a further extension. On the others work is practically at a standstill. Of the less pretentious lines the Louisville & Nashville has a line under construction in the western part of the state and the Morristown & Cumberland Gap is grading a line from Morristown northeast. The other enterprises are sufficiently described in our detailed list.

Taking the work at a whole, it is seen, that while construction is less active than it was a year ago, lines are in most cases projected to supply needed facilities and will prove profitable additions to the railway system of the South.

To the North Pole, via Greenland.

Mr. ROBERT E. PEARY, Civil Engineer, U. S. N., has started on his adventurous expedition toward the North Pole through the interior of Greenland. In a private letter received just before his departure, Mr. PEARY remarks that the chance of the continent of Greenland extending unbroken to the North Pole is very small indeed; and while a more or less scattered archipelago may connect Greenland with Franz Josef Land, there are circumstances opposed even to this. On the southern extremity of Robeson's Channel, separating Grinnell Land from Greenland, there is a meeting of the tides, one coming from the south and the other from the north. The tide from the

north is a north Atlantic tide, and it has presumably rounded the northern terminus of Greenland. This circumstance and the general trend of the eastern and northwestern coast lines of Greenland point almost conclusively to the termination of that continent at some distance south of the Pole.

This expedition promises to be both a most interesting one from the route selected, and of great geographical value in gathering information from a country as yet unknown. As Mr. PEARY says in the letter referred to, it is idle to attempt to guess what ought to or might be found in Greenland simply from the teaching of analogy or the application of scientific laws. Baron NORDENSKJOLD proved conclusively (on paper) that an ice-cap covering all inner Greenland was a physical impossibility; and while there was undoubtedly a fringe of ice along the coast-line, the interior should be open and perhaps covered by forests, and he confidently expected to find therein the remains of the Norseman's rule, in the days of ERIC the Red, perhaps. Yet when he upset his own theory by an expedition, starting in from the east coast and only ascending as high as about 69° north, he found that the interior ice-cap was there. Gen. GREELY, on the other hand, found the northern part of Grinnell Land, as far north as 82°, free from ice; and now theorists are not wanting who prove "conclusively" that the same condition of affairs must exist for Northern Greenland.

PETERMANN, the greatest geographer of modern times, and belonging to a nation noted for delving to the primordial atoms in all they undertake, also made a mistake. He showed "conclusively," too, that by all terrestrial laws and analogies Greenland must be a continent extending across the Pole and terminating in Wrangel Land. He died in that belief; and yet Wrangel Land is now known to be but a small island, with nothing in the form of land in sight to the north.

Few realize that a vast region, covering over 1,500,000 square miles, lies about the North Pole, which has never been as yet visited by man. This leaves a wide margin for theory and guessing. North of latitude 80° there are only two points of land that have ever been explored; the north of Grinnell Land, on one side, and Franz Josef Land, bordering the European continent. Gen. GREELY'S expedition, in 1882, touched 83° 24' north, the highest point ever reached; and the PAYER-WEYPRECHT expedition of 1874, which discovered Franz Josef Land, ascended to 82° 5' north latitude. The English explorers, Captains NARES and STEPHENSON, in 1876, planted their flag as far north as 83° 20'; but this flag was proudly carried off by GREELY and rescued along with his party. Capt. PARRY, however, as long ago as 1827, sailed north of Spitzbergen to 82° 25' north latitude, but did not find land.

Of the interior of Greenland, which Mr. PEARY proposes to traverse, very little is known at all. The few explorers who have attempted to penetrate to this region report simply a desolate waste of ice after the mountains of the coast are passed. NORDENSKJOLD, who reached an elevation of 6,600 ft. above the sea, by a gentle slope, found no land appearing—nothing but an unbroken ice field covered with about 4 ft. of snow. The Danish expedition of 1878 found this snow difficult to travel through, and they were at times in great peril from hidden crevasses of great depths. Altogether it is a very unpromising land to explore, and the scientific world can only hope that the present expedition, which commences its labors as high north as 76° of latitude, may return in safety and without the sad experience of Gen. GREELY'S party in a comparatively less desolate region.

Dr. NANSEN, the Norwegian explorer, who has already headed an expedition to Greenland, is also planning to reach the North Pole, but by a different route. He proposes to take a ship of peculiar construction through Bering Strait and then toward the New Siberian islands, whence he expects to meet a current that will guide him to an open Polar Sea.

Dr. NANSEN has little confidence in a land journey to the extreme north, and his objections seem well founded. His own trip demonstrated the feasibility of land travel when sufficient provision is made for food and clothing. But he says the sledge-boats used on land are not suitable for a voyage by sea, and the animals used for pulling them could not be taken on board. Consequently, if the expedition ever reached an open sea, the alternative would be presented of either turning back, or of abandoning the animals and of thus cutting off hopes for a return by the same means. Such an expedition would also require considerable force to convey the needed supplies; and, in case of disaster, its track would be exceedingly difficult to follow, as it would be impossible to foresee what route it might be forced to take by the condition of the ice.

As we understand Mr. PEARY'S intention, however, he has little or no hope of reaching the North Pole, or even approaching it closely. His main object is to discover what there is in the extreme north of Greenland, as far as that continent itself will carry him. He takes with him on this trip a very small party, five in all, we believe, and will first establish a line of provisioning stations as far north as possible before setting out on his journey proper. The sleds will be drawn by hand, and the men themselves will use the Norwegian *ski*. He will thus have to deal with a minimum of supplies on his extreme northward march, and on his return will replenish from the stations established. Judging from the trend of the upper end of Greenland, as we know it, he should succeed, all other things being well and the icy plateau reaching to the end, in passing further to the north than Gen. GREELY, and consequently further north than has yet been attained. This would be sufficient honor for any man, aside from the valuable data that will be brought back relating to this now unknown land. Mr. PEARY is not inexperienced in Arctic travel, for he has been there before; and his plans are laid, and will be doubtless carried out, in the light of this previous experience. He is going deliberately to work, with a full appreciation of the difficulties and the dangers of his plan. He and his companions brave these dangers in the interest of the advancement of geographic and scientific knowledge, and the rest of the world can only wish them success in their enthusiastic labors and a safe return—and wait.

CORRESPONDENCE.

Notes on English Railways: Overcrowding of Trains.

LONDON, England, May 21, 1891.

TO THE EDITOR OF ENGINEERING NEWS:

SIR. In the article on the Metropolitan Railway, of London, in your issue of May 2, it is stated that "overcrowding is rare, the laws and regulations on this point being pretty well enforced in England." If you could travel on the Metropolitan Ry., the Midland Ry. local lines or the North London Ry. from Dalston Junction to Broad St., between 8 and 9 A. M. or 6 and 7 P. M., I think you would alter that opinion. When traveling daily from Highgate Road station to Aldergate St., in the city, it was quite an exception to get a seat, even the guard's van in the middle of the train being filled with passengers standing, and it was just the same in the evening. This overcrowding is general on many of the local and suburban lines, and how can the officials interfere? If they did, the crowds on the platforms would increase, so they are only too glad to get the people off by the trains, and unless a very vigorous complaint is made they do not trouble to see the regulations carried out. In fact, on the Midland Ry. it is not painted up in the compartments how many passengers are intended to sit on each side. The ordinary number in second and third class cars is 5 on each side, or 10 to a compartment, but more than once, when a row was made about overcrowding and the guard was applied to, he stated that six could easily sit each side, although as a matter of fact it was a tight squeeze.

F. T. T.

The Greytown Jetty.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: The diagnosis presented in your issue of May 30 as to the origin of the bar and the efficiency of the jetty at Greytown is another confirmation of the principles set forth in the papers read before the American Philosophical Society in December, 1887, and the American Society of Civil Engineers in June, 1890, showing the importance of controlling the littoral drift rather than of attempting to concentrate the ebb currents over an outer bar. In a consultation with Chief Engineer MENOCAL, before these works were projected, it was stated that by arresting the westward motion of the sand forming the bar by a single jetty near the eastern end of the bar a good channel could be formed and maintained across it, while two jetties would be unnecessary.

This plan has been carried out in substance, and the results are remarkably satisfactory. The same plans were presented to the Board of Engineers at New York in February, 1888, but were rejected on the ground of their impracticability, and the opportunity to apply them to some of the important alluvial harbors of the country has therefore been lost, while the inefficient twin-jetty plan is continued to the injury of the ports and at great expense to the country.

The cyclic character of the movement and the preponderance of the external forces which mold this bar are very well described in the contribution of the editor, and make it one of the typical cases referred to in the Physical Phenomena of Harbor Entrances.

LEWIS M. HAUPT, M. Am. Soc. C. E.

A Correction.

NEW YORK, June 2, 1891.

TO THE EDITOR OF ENGINEERING NEWS:

SIR: Our attention has been called to a statement on page 183 of your MANUAL OF AMERICAN WATER-WORKS, under the sub-head, "Stapleton and Edgewater," which is wholly in error and does us great injustice. It is as follows:

"Distribution.—(In '84) Mains, spiral welded iron, 13 miles; afterwards replaced by c. i."

As this statement has done us injury please correct it in accordance with the facts, whatever they may be.

There were no spiral-welded tubes of any kind made in 1884. The Spiral Weld Tube Co. was not organized until 1887, and did not begin producing until two years later. No spirally welded tubes were ever made of iron, except experimentally, steel being the material of all which have been sold. None were used in any part of the Stapleton and Edgewater system, and, so far as we are aware, none have ever been replaced by cast iron or other substitute.

Respectfully,

The Spiral Weld Tube Co.,
JAMES C. BAYLES, President.

[The mains were reported for the MANUAL as "sheet-iron spiral pipe," and inadvertently appeared as spiral-welded iron. Mr. BAYLES' letter makes it evident that his spiral-welded pipe could not have been in question, and we can only trust that this explanation will set the matter in its proper light.—ED. ENG. NEWS.]

Notes on English Railways.

(*Continued from page 494.*)

LONDON & SOUTHWESTERN RAILWAY.

Locomotives.—In connection with the article on this road on pp. 382 and 478, Mr. W. ADAMS, Locomotive Superintendent, states that he prefers outside cylinders for express passenger engines, with a truck in front, as the working parts are more accessible than in the case of inside cylinders, while the absence of a crank on the driving axle enables a longer firebox to be used. For freight engines with six wheels, all coupled, where the whole weight of the engine must be utilized for driving, inside cylinders are more convenient. The green color for the engines is considered brighter than the brown formerly used, but no other reason for the change is given.

All the railways thus far described in this series of articles have been the main trunk lines and the London local lines, all having heavy traffic. In the present article some particulars are given of a few of the smaller lines.

BRISTOL PORT RAILWAY.

This is a very short line, having only about 6 miles of single track, with passing places at stations. It was originally built (about 1863) for passenger traffic only, having no connections. It starts from a small station on the outskirts of the city of Bristol, and follows the course of the River

Avon to the village of Avonmouth at its entrance to the Bristol Channel. Some years after the road had been in operation a large dock was built at Avonmouth by a company, in competition with the Bristol city docks, and this led to the construction of a line known as the Clifton Extension Ry., to connect the dock with the railways entering Bristol. A portion of the Bristol Port Ry. was utilized, and eventually the whole line was acquired by the Great Western and Midland railway companies, and turned over to them on Sept. 1, 1890. An extension is projected from the present terminus through the city to connect with the harbor railway. Under American management a summer excursion resort would probably have been established at Avonmouth. The dock has now been acquired by the city of Bristol. The route of the line and its connections are shown in Fig. 67.

Track.—The line is laid with flange or T rails, and the part not used by the through freight traffic is very light, but good enough in general, with some exceptions, for the extremely light traffic which it carries. The exceptions noted comprise short sections of very dilapidated track, with rails badly worn, broomed and battered, some of them having pieces split off the ends and sides of the heads. In some cases there is a space of ⅜-in. between the rail ends. The ordinary rails are about 4⅝ ins. high, 4⅛ ins. width of base, 2⅝ ins. width of head. They are laid with square, suspended joints, spliced

Fig. 67. Map of Bristol Port Ry. and Clifton Extension Ry.; Bristol, England.

by plain splice bars 16 ins. long, 2¾ ins. deep, with 4 bolts ⅝-in. diameter, having heads either round or 1⅞ ins. square. The nuts are on the outer side of the rail. The inner bars have circular holes. The two middle bolts are spaced 4 ins. c. to c., and the outer ones 3 ins. There are two spikes to each rail on every tie, the older ones having rectangular and the newer ones tee-shaped heads. Some of them have been partly pulled out even under the light traffic. Fang bolts are also used, as shown in Fig. 68, in which *A* is the arrangement used on some shoulder ties, and *B* that used on some parts of the older track. The ties are generally of half-round section, with seats adzed out for the rail, and some of them deeply flange cut. The newer ones are creosoted. They are irregularly spaced, from 30 to 36 ins. c. to c. at joints, and 42 ins. intermediate. Some of them are so much out of place as almost to come under a joint. The old track has 7 ties to a rail length of 18 ft., and new 30-ft. rails have 10 ties. The ballast is of limestone, in very large pieces, level with the tops of the ties and rounded off from their ends. A special and interesting feature of the old track is the use of tie rods at curves. They are round rods about ⅞-in. diameter, with 2 nuts on the outer side of the rail, and are placed at the joints and middle of the rails. Those at the joints take the place of one of the splice bolts of each joint, and at the middle of the rail a piece of splice bar 3½ ins. long is placed on the outer side of the rail for the nuts to bear upon. Between Avonmouth and the junction there is a pretty good track of flange rails with spikes and fang bolt fastenings, as shown at *B*, Fig. 68, except that the clamps are 2½ ins. instead of 2 ins. square. On a bridge at Sea Mills the rails are carried on longitudinal timbers, with iron and wood shims to prevent flange cutting. It is probable that the other part of the track will now be thoroughly overhauled.

Locomotives.—The line has been worked by small, old-fashioned tank engines with 6 wheels, having the 4 rear wheels coupled. The cylinders were inside the frames, placed very low down under the smokebox. The coupling rods were of round section. At the end of the run the fireman would walk along the running board and place a damper like a large stove lid on the top of the smokestack. A Great Western Ry. tank engine of similar type, but much larger and of modern construction, is now also used.

Rolling Stock.—This consisted of small four-wheel cars of cheap and light construction. The traffic is mostly third class, consisting of dock laborers and the "volunteer" soldiers to or from the rifle range at Avonmouth. There is a little first-class saloon car, about 20 ft. long, which is quite a curiosity, and of which a sketch is given in Fig. 69. It is upholstered

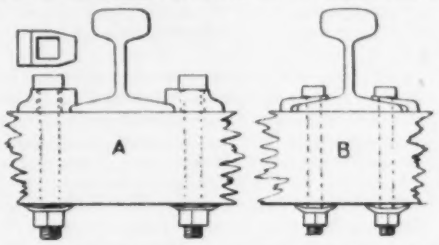

Fig. 68. Bolt Fastenings for Flange Rails; Bristol Port Ry., England.

in dark blue cloth, but is in a very dilapidated condition. It is divided into 2 compartments, one of which is for smokers.

CLIFTON EXTENSION RAILWAY.

This is the line already referred to as having been built (about 1870) to connect the Avonmouth dock with the railways at Bristol, and its route is also shown on Fig. 67. West of the Clifton Down station there is a long tunnel through limestone. Near the river end it comes near the face of a vertical cliff, and a narrow branch tunnel was therefore driven to the face, and the debris dumped into a disused quarry below, the branch tunnel being afterwards closed by an iron grating. Originally the tunnel was unlined, and the inspectors of the Board of Trade refused to sanction the opening of the line. The company claimed that this work was unnecessary and beyond its means, so that for several years the line was not operated for passenger traffic beyond Clifton Down, although freight trains were run through—about two trains per day. Eventually, however, the tunnel was lined, and the road opened for regular traffic. The road is operated by the Great Western and Midland railway companies, the traffic consisting of light passenger trains hauled by tank engines, and freight trains hauled by engines with six wheels, all coupled.

Track.—Between Bristol and Clifton Down the line is laid partly with the Great Western Ry. and

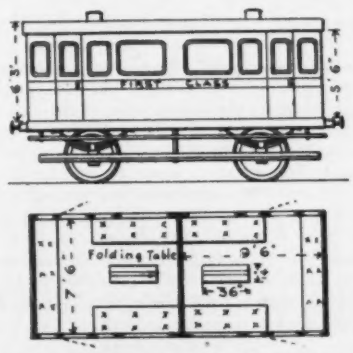

Fig. 69. Old Saloon Car; Bristol Port Ry., England.

partly with the Midland Ry. standard type of track, with bull head rails in chairs on cross ties. From Clifton Down through the tunnel and to the junction with the Bristol Port Ry. there is a double track of heavy flange rails about 5 ins. high, 5¼ ins. width of base, and 2½ ins. width of head. They are laid with square suspended joints, spliced with plain splice bars 18 ins. long, with 4 button-head bolts ⅝-in. diameter, spaced 4½ ins. c. to c. and with nuts 1⅝ ins. square on the outer side of the rail. The rails are 23 ft. long, with 9 ties to a rail length, the ties being spaced about 27 ins. c. to c. at joints, and 30 to 32 ins. c. to c. intermediate. The ties are 9 ft. × 10 ins. × 5 ins., and are creosoted. Some are flange cut. The ballast is of broken stone, nearly level with the tops of the ties and extended well beyond their ends. In the tunnel it is level from wall to wall. The rails are fastened to the ties by spikes and ⅝-in. fang bolts, the latter passing through ⅞-in. holes in the rail flange, with the 1¼-in. square head screwing down on the flange. Each rail has spike and a bolt to each tie, and the fastenings are arranged alternately with both bolts inside and both spikes outside, and vice versa. On curves every other tie has 2 spikes on the outer side of the outer rail, and 1 bolt on the inner side; the alternate ties having 1 spike and 1 bolt to each rail as usual. From the tunnel there is a down grade of 1 in 64 (1.56%) on a sharp curve to the junction. At the foot of this grade, on the up track, there is a derailing switch and a short piece of track leading into a bank, to prevent accident in case of a train breaking or running back. The junction is laid with the Great Western Ry. type of bull-head rails in chairs, with a fang bolt on each side of each chair, the heads of the bolts screwing down on the chair. The wooden keys are on the outer side of the rail, and are split at one end, a thin wedge of wood being driven into the crack after the key has been driven home. The switch rods are of 1¼-in. gas pipe with screw couplings. Beyond the junction there is a single track.

SEVERN & WYE & SEVERN BRIDGE RAILWAY.

This is mainly a mineral road, consisting of a number of lines traversing the Forest of Dean district in Gloucestershire, and serving the numerous collieries, iron mines, steel works and other manufacturing establishments. The Dean Forest coal field is about 9 by 6 miles. It does not produce good steam coal, so that South Wales coal is used for the locomotives and the drawbridge engines. The main line commences at Berkeley, by a junction with the Midland Ry., crosses the River Severn by a long, high-level bridge to Lydney, and then runs through the forest to Lydbrook, where it connects with a line of the Great Western Ry. There are numerous other lines and branches, the total length being about 33½ miles. All the lines have a very winding location, with frequent curves of 462 to 800 ft. radius, and the grades are very heavy, aggregating several miles of 1 in 50 to 1 in 30 (2 to 3.3%). The working load on the Severn Bridge section is 320 gross tons; between Lydney and Speech House, 7 miles, with a maximum grade of 1 in 106 (0.94%), 200 tons; thence to Serridge Junction, 1½ miles, with a maximum grade of 1 in 40 (2.5%), 100 tons; and thence to Lydbrook, 4½ miles, with a maximum grade of 2%, 120 tons. On a loop line 6½ miles long, used mainly for mineral trains, the working load is 100 tons; the engine brings a train of 40 cars to the beginning of the line, and then takes the train up in two sections, over grades of 2.5 and 1.06%. On the Coleford branch, 3½ miles long, with a grade of 3.3% for 2½ miles, combined with curves of 528 ft. radius, the working load is 70 tons. An interesting feature of this line is that it has two switchbacks; one at the junction of the Coleford branch, and the other at Serridge, on the through line to Lydbrook. The line is operated by Tyer's electrical train tablet system. The tablet is inclosed in a leather pouch to which is attached a wire loop. As a train enters a section the signalman holds out the pouch from the window of his cabin, and the engine driver catches the loop on his arm. At the end of the section the driver hangs the pouch by the loop over a bracket on a post at the side of the track.

Track.—Some parts of the line are laid with track of the ordinary English type, with double-head rails, and in other parts with flange rails carried on iron chairs to prevent the rails from cutting the ties or spreading. The track was described in detail in ENGINEERING NEWS, July 7, 1888, in an abstract of the writer's paper on "English Railway Track." A number of quarry lines in this neighborhood are laid with angle iron rails 4 ins. wide and 2½ ins. high on stone blocks. The vertical leg is on the inner side of the track, and the cars have wheels with narrow flangeless rims. Some of the rails are 3 ft. long, with a notch in the end for the spike. There are also longer ones, 12 ft. long, carried in cast-iron chairs. Channel rails, with the tops of the vertical legs notched or cogged, are used occasionally on curves. A cross-section of both kinds of track is shown in Fig. 70.

Locomotives.—The line is worked by side tank engines, with outside cylinders and six wheels, all coupled. The freight engines have 16-in. cylinders. The engines have independent brakes, but the engine driver has control of the brakes on the cars of passenger trains by means of a cord. The Lechatelier brake was used at one time, but has been given up,

and some of the engines are now being fitted with Eames vacuum brake. Coal trains coming down the grades of 2.5% stop at the summit and the brake levers are pinned down on about every third car, the rule being that the engine must steam a little to start down the grade. The engines are painted a light yellowish green.

Rolling Stock.—The passenger equipment consists of short cars of very light construction, carried on 4 spoke wheels, and having the body divided into 4 compartments, or 3 and a baggage compartment. They are painted a sepia brown, with yellow lettering. The Clark chain brake (non-automatic) is fitted to the passenger cars, and it is used at all stops. The grinding of the wheels, the noise and vibration of the cars and their lurching motion on the curves make riding very unpleasant. This is due mainly to the use of such small, light cars. Some large Midland Ry. cars on four-wheel trucks are run over the line, even on the Coleford branch, with its 528 ft. reverse curves, and ride much more quietly and steadily.

Severn Bridge.—This bridge was commenced in 1875 and opened in 1879. It is a single-track through bridge, with riveted bowstring girders. Each pier consists of a pair of cast iron cylinders filled with concrete and connected by bracing. The cylinders are 7 to 10 ft. diameter, and are sunk to bed rock. On the channel span piers the compressed air system was used, with pressures of 15 to 30 lbs. For driving piles for temporary work an American gunpowder pile-driver was used at one time, but was abandoned. The depth from high water to rock was from 40 to 70 ft. The rise of water at spring tides was 30 ft. in 2 hours,

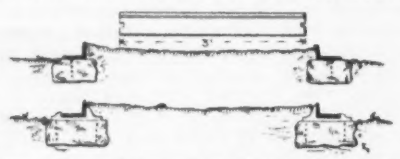

Fig. 70. Quarry Lines with Angle-Iron Rails on Stone Blocks; Gloucestershire, England

and the current 10 miles per hour. The spans were as follows, beginning at the south end: Swing span over the Gloucester & Berkeley Ship Canal, 196 ft.; 13 spans of 134 ft., 5 of 171 ft., 2 of 327 ft. (over the navigable channel), and 1 of 134 ft., a total of 21 spans and 3,385 ft., exclusive of the draw span. There is no approach on the south, the railway running from a cut directly onto the draw, but at the north end is a masonry viaduct of 13 arches, 70 ft. high, with an elliptical arch 52 ft. span across the Great Western Ry. The width of the river at this point is 3,555 ft., and the total length of the bridge, including the draw and the north approach, is 4,161 ft. The top and bottom chords of the spans are connected by vertical members which carry the cross girders. Small longitudinal girders between the cross girders support the rails, and the floor is made of plate-iron decking. The higher parts of the main girders are connected by cross bracing. The girders are painted a pale yellow or buff, and the piers chocolate brown. The track consists of rails of bridge section bolted to longitudinal timbers by fang bolts passing through the flanges. Inside angle-iron guard rails are also bolted to the longitudinals. Transoms or cross timbers are placed at intervals between the longitudinals and between the girders and longitudinals. The draw span is built for a double track, and has a center pier, the part over the canal being balanced by a part projecting over the foreshore of the river. Its weight is between 400 and 500 tons. The abutments and circular swing pier are of masonry. The draw is carried on a turntable with 23 conical rollers. The turning machinery is driven by a double cylinder, horizontal, 20 HP. steam engine and a vertical tubular boiler. This plant is situated in a house built over the tracks, and a duplicate engine and boiler are provided, the two being used for alternate fortnights. The power is transmitted to the turning and locking machinery by a friction gear and worm. When the draw is swung into position for railway traffic, a catch is lowered which makes an electrical connection, and rings a bell in the engine house, indicating that the bridge is in position for locking. Two screws, one on each side of the bridge under the flooring, driven by bevel gearing, then force out a horizontal locking bolt and a wedge at each end, the screws having a right-hand thread on one end and a left-hand thread on the other. The wedges project from the sides of the ends, and raise the bridge when driven home to a bearing. The locking bolts enter sockets in the abutments. The locking apparatus is interlocked with the signals, so that a "track clear" signal cannot be given unless the draw is in safe position. Mr. GEO. W. KEELING, M. Inst. C. E., was one of the principal engineers of the bridge, and is now the Chief Engineer and General Manager of the whole railway.

MIDLAND & SOUTHWESTERN JUNCTION RAILWAY.

This is a north and south line about 63 miles long, intended to connect the London & Southwestern Ry. at Andover with the Great Western Ry. at Swindon and the Midland Ry. at Cirencester. From Andover to Marlborough and Swindon it is operated by the London & Southwestern Ry., and Great Western Ry. trains also run from Swindon to Marlborough. The line is operated on the train staff system, and semaphore signals are also used. The water tank at Marlborough is filled by a horse-power pump, the horse walking in a circular path.

Track.—The line is single track, laid with Krupp steel flange rails made in 1881. At joints they rest on iron tie-plates, one side of the flange being held by a lug on the tie-plate, and the other by a clamp and fang bolt. On other ties each rail has a spike on one side, and a clamp and bolt on the other, the spikes being placed both inside and both outside alternately. Some of the bolts have the heads and some the nuts on top. The joints are supported, spliced with plain splice bars, with four bolts having the nuts on the inner side of the rail. The ballast is of flint and coarse gravel. Iron distance posts are used, similar to those of the Great Western Ry., Fig. 5, p. 174. On bridges, longitudinal timbers are used. A side track was noticed which had a derailing switch to prevent cars from fouling the main track. The line is well fenced with a fence of five wires carried in grooves in wooden posts. Farm and crossing gates are strongly built of wood, and are painted white, with "Shut the Gate" painted in black on the top rail. On each gate is an iron plate with references to by-laws and penalties respecting farm-gates, but these plates are merely a formality, and are generally rusty and illegible. The stations are very plain, built of brick, with freestone trimmings. The platforms are graveled, and edged with blue coping bricks, and sometimes paved with the same in front of the station building.

Locomotives.—The line is worked by light side-tank engines.

Rolling Stock.—As on most lines of this character which are operated by main line companies, the equipment consists of the operating company's oldest and commonest rolling stock, and there is a very unpleasant transverse motion of the cars when running at any speed. The London & Southwestern Ry. third-class cars have uncomfortable seats, with thin cushions and a strip of padding along the partition. The interior is painted and grained yellow, with the roof white. The lamp globes sometimes contain 2 or 3 ins of dirty oil that has leaked in from the lamp. In each partition is a small disk of glass, by which passengers are supposed to be able to give an alarm to other passengers in case of an attempt at assault or robbery.

(To be continued.)

Legal Decisions of Interest to Engineers.

Fires on Railway Right of Way.—The act of a railway company in starting a fire on a bed of peat, upon which its track is laid, at a season of great drought, is a positive wrong, which renders it liable for injury to adjacent property. The fact that the plaintiff's land was not the first to be reached by the fire will not prevent a recovery. (Louisville, N. A. & C. Ry. Co. v. Nitsche, Supr. Ct. Ind., 26 N. E. Rep. 51.)

Condemnation Proceedings.—The charter of the city of St. Paul authorizes the city to acquire, by condemnation, easements for slopes in grading street. To make proceedings for taking private property for public use valid, personal notice to the owner is not a constitutional requisite. A description of the land to be taken in the notice required by the charter of defendant is sufficient, if from what it contains, and the facts which the owner is charged with notice of, he is apprised of what property is proposed to be taken. The owners of lots fronting on a street are charged with notice of the street grades, when established as provided in defendant's charter, and the profiles are filed as therein required. Although an easement for a slope for a street grade may be abandoned by defendant, an intention to abandon will not be established by the mere fact that defendant built a retaining wall along the street line.—(Kuschke v. City of St. Paul, Supr. Ct. Minn., 47 N. W. Rep., 786.)

Statistics Showing the Progress and Prospects of Railway Construction in the Southern States.

(WITH MAP NO. 36.)

VIRGINIA.—Existing Roads.

1. ***Abingdon Coal & Iron.***—Under construction, Abingdon to Damascus, 15 miles. Surveyed Abingdon to Mendota, 24 miles. Chief Engineer, J. C. Watson, Jr., Abingdon.

2. ***Atlantic & Danville.***—Track laid in 1890, Buffalo Junction to Buffalo Lithia Springs, 4 miles; Bellfields to Hitchcocks, 8.25 miles; Savedge to Allcott's Mills, 6 miles; Mayo to North Carolina line, 10 miles.

3. ***Baltimore & Ohio.***—Projected, Lexington to Roanoke, 50 miles.

Chesapeake & Ohio.—Track laid in 1890, branch to Rich Patch mines 6 miles. Craig Mineral R. R.—Eagle Rock toward New Castle, 5 miles. Track laid since June 1, 1891, point 5 miles from Eagle Rock toward New Castle, 15 miles. Under construction, end of track to New Castle, 5 miles.—Covington-Warm Springs Branch.—Track laid since June 1, 1891, Covington north, 10 miles. Under construction, end of track to Warm Springs, 14 miles.

4. ***Danville & East Tennessee.***—Under construction, Bristol, Tenn., to Damascus, 27 miles. Surveyed, Damascus to Danville, 150 miles. Chief Engineer, T. Wain-Morgan Draper, Norfolk.

5. ***Farmville & Powhatan.***—Track laid in 1890, Sunny Side to Farmville, 24 miles. Located, Farmville to Hampden Sidney College 7 miles. Projected, Hampden Sidney College to Brook Neal, 30 miles; Cumberland to Appomattox, 50 miles.

6. ***Fincastle & Troutville.***—Under construction, Fincastle to Troutville, 6.75 miles. President, E. B. Simmons, Fincastle; Chief Engineer, E. Grover, Newcastle.

Glasgow Belt.—Under contract, belt line railway at Glasgow, Va., 6 miles. Contractor, E. D. Swift, Glasgow.

7. ***Louisville & Nashville.***—Cumberland Valley Branch.—Track laid in 1890, Cumberland Gap toward Newton, 30 miles. Track laid since Jan. 1, 1891, end of track to Norton, 40 miles. Under construction, Big Stone Gap up Callahan's Creek, 4 5 miles.

8. ***Lynchburg & Durham.***—Track laid in 1890, South Boston to North Carolina line, 12 miles.

9. ***Norfolk & Western.***—New River Branch.—Track laid in 1890, Ivanhoe to Great Outburst, 15.41 miles. Under construction, Great Outburst to North Carolina line, 20 miles.—Track laid in 1890, Honaker to Norton, 46.5 miles; near Doran to mines, 1.2 miles; Richlands to mines, 4.16 miles; Washer to Bettie Baker, 6.28 miles. Under construction, branch up Little Tom Creek, 4 miles. Projected, Front Royal to Washington, D. C., 70 miles.

10. ***Orange & Keysville.***—Surveyed, Keysville to Arvon, 50 miles. Projected, Arvon to Gordonsville, 50 miles. President, John Goodwin, Baltimore, Md.; Chief Engineer, W. A. Dafter, Farmville.

Petersburg & Asylum.—Under construction, Petersburg to Maloaca, 6.75 miles. President, Geo. Beadle, Petersburg.

Richmond & Chesapeake.—Projected, Richmond to Wycomico, 50 miles.

Richmond & Petersburg.—Track laid in 1890, James River to Clopta, 5 miles.

Richmond & Tidewater Coal.—Track laid in 1890, Coalfield to Tomahawk, 5 miles.

Richmond, Fredericksburg & Potomac.—Track laid in 1890, Arca to James River, 3 miles.

11. ***Roanoke & Southern.***—Track laid since Jan. 1, 1890, North Carolina line to Martinsville, 12 miles. Under construction, Martinsville to Roanoke, 55 miles.

12. ***South Atlantic & Ohio.***—Track laid in 1890, Natural Summit to Big Stone Gap, 21 miles.

Staunton & West Augusta.—Surveyed, Staunton to coal fields, 25 miles. C. S. Dyott, 52 Wall St., New York City.

Staunton Development Co.—Under construction, line to company's mines, 2.5 miles.

Projects and Surveys.

13. ***Bedford & James River.***—Surveyed, Bedford City to James River, 20 miles. Secretary, W. S. McKinney, Bedford City.

14. ***Blacksburg.***—Projected, Blacksburg to Roanoke 32 miles. President, J. F. Christian, Roanoke; Secretary W. H. Graham, Blacksburg.

Broadway & West Virginia.—Under survey, Ottobine to Front Royal, 80 miles. President, Frank H. Steele, 38 Wall St., New York City.

Charlottesville & Southern.—Projected, Charlottesville to James River, 24 miles. President, R. P. Valentine, Charlottesville.

Norfolk & Portsmouth Belt.—Projected, belt line at Norfolk and Portsmouth, 10 miles. C. G. Elliott, Norfolk.

Northern Neck.—Projected, Fredericksburg to Chesapeake Bay, 80 miles. E. D. Booker, Farnham.

15. ***Virginia & Kentucky.***—Projected, Danville to Kentucky line, 210 miles. President, David S. Peirce, Wythville; Chief Engineer, A. V. Sims, Danville.

Total.—Track laid in 1890, 212.75 miles. Track laid since June 1, 1891, 77 miles. In process of construction, 200 miles. Surveyed or under survey, 393 miles. Projects of some promise, 813 miles.

NORTH CAROLINA.—Existing Roads.

16. ***Albemarle & Pantego.***—Track laid in 1890. Extension to Crosswell, 4 miles; extension to Belle Haven, 2.5 miles.

17. ***Asheville & Bristol.***—Surveyed Asheville to Bristol, Elizabethton & North Carolina R. R., 55 miles.

Asheville & Craggy Mt.—Track laid since Jan. 1, 1891. Asheville toward Craggy Mt., 2 miles. Under construction, end of track to Craggy Mt., 4 miles. President, W. B. Gwyn, Asheville.

18. ***Atlantic & Danville.***—Track laid in 1890. Viscarel to Blue Wing Creek, 3.25 miles; Milton to the Virginia line, 17 miles.

19. ***Atlantic Coast Line.***—Scotland Neck Branch.—Track laid in 1890, Greenville to Kingston, 24 miles. Projected, Kingston to Jacksonville, 85 miles.—Wilson & Fayetteville R. R.—Under construction, Fayetteville to Rowland, 40 miles.—Washington Branch.—Surveyed,

Greenville to Washington, 20 miles.—Projected, Spring Hope to Durham, 45 miles.

19. ***Cape Fear & Yadkin Valley.***—Track laid in 1890, Roseboro to Fayetteville, 32 miles; Millboro to Ramseur, 9.02 miles; Mt. Airy to Flat Rock, 2.02 miles. Graded, Mt. Airy to Virginia line, 7.5 miles.

20. ***Charleston, Cincinnati & Chicago.***—Track laid since Jan. 1, 1890. Rutherfordton to Marion, 15 miles. Partly graded, Marion to Tennessee line, 70 miles.

21. ***Egypt.***—Track laid in 1890, Egypt to Egypt Junction, 8 miles.

22. ***French Broad Valley.***—Partly graded, Asheville to South Carolina line, 60 miles; Mills River to Rutherfordton, 40 miles.

8. ***Lynchburg & Durham.***—Track laid in 1890, Virginia line to Durham, 41 miles.

23. ***Richmond & Danville.***—Yadkin R. R.—Track laid in 1890, Salisbury to Bilesville, 24 miles. Track laid since Jan. 1, 1890, Bilesville to Norwood, 17 miles.—Western North Carolina R. R.—Track laid in 1890, Andrews to Tomotla, 10 miles. Track laid since Jan. 1, 1890, Tomotla to mile post, 122.4, 4.4 miles.—Greensboro & Wilkesboro Branch.—Track laid in 1890, Siloam to Wilkesboro, 42 miles. Projected, Wilkesboro to Bristol, Tenn., 80 miles.—North Carolina Midland.—Track laid since Jan. 1, 1891, Winston to Mocksville, 25.8 miles. Under survey, Danville, Va., to Winston, 70 miles; Mocksville to Mooresville, 30 miles.

11. ***Roanoke & Southern.***—Track laid in 1890, Dan River to Virginia line, 24 miles. Under survey, Wins on to Monroe, 85 miles. Projected, Walnut Cove to Danbury, 10 miles.

23½. ***Seaboard & Roanoke.***—Murfreesboro.—Track laid since Jan. 1, 1891, Murfreesboro to Pendleton, 7 miles.

24. ***Southern & Western Air Line.***—Partly graded, Shelby, north, 23 miles. Located; end of grade to Linville, 77 miles. President, S. McD. Tate, Morgantown.

25. ***Wilmington, Chadbourn & Conway.***—Track laid in 1890, Chadbourn to mills, 2 miles. Under construction, mile post 2 to mile post 11, 9 miles. Projected, mile post 11 to Lumberton, 21 miles.

26. ***Wilmington, Onslow & East Carolina.***—Track laid in 1890, Wilmington to Jacksonville, 50 miles. Located, Jacksonville to New Berne, 38 miles. Chief Engineer, F. L. Pitman, Wilmington.

Projects and Surveys.

27. ***Atlantic, Asheville & Baltimore.***—Projected, A lanta, Ga., to Roanoke, Va., 400 miles. President, Natt. Atkinson, Asheville.

28. ***Bennettsville & Gibson Station.***—Projected, Bennettsville to Gibson Station, 15 miles. President, F. B. Gibson; Secretary, C. P. Townsend; both of Gibson Station.

29. ***Charleston, Wilmington & Northern.***—Projected, Charleston to Wilmington, 160 miles. President, J. C. McNaughton; Chief Engineer, John Runk; both of 228 Dock St., Philadelphia.

30. ***Cranberry & Linville.***—Projected, Cranberry to Linville, 13 miles. President, Hugh MacRae; Chief Engineer, J. R. Irwin; both of Linville.

31. ***Fayetteville & Aberdeen.***—Projected, Fayetteville to Raleigh & Augusta R. R., 45 miles. Secretary, J. W. Whitehead, Fayetteville.

32. ***Greensboro, Roxboro & Eastern.***—Projected, Blue Wing to Greensboro, 70 miles. Thos. B. Hunt, Greensboro.

33. ***Hoffman & Troy.***—Projected, Hoffman to Troy, 27 miles. President, L. J. Jones; Secretary, D. A. McKinnon, both of Raleigh.

34. ***Northampton & Hertford.***—Projected, Garysburg to Tunis, 40 miles. President, H. W. Lewis; Treasurer, J. A. Burgwyn; both of Garysburg.

35. ***Oxford & Coast Line.***—Projected, Oxford to Wilson, 60 miles. H. C. Herndon, Oxford.

36. ***Thomasville, Silver Valley & Pee Dee.***—Surveyed, Winston to Wadesborough, 99.25 miles. P. C. Thomas, Thomasville.

37. ***Wilmington & Southern.***—Surveyed, Wilmington to Southport, 25 miles. Jas. Sanders, G. W. Williams; both of Wilmington.

Total.—Track laid in 1890, 288.79 miles. Track laid since June 1, 1891, 80 miles. In process of construction, 354 miles. Surveyed and under survey, 659 miles. Projects of some promise, 736 miles.

SOUTH CAROLINA.—Existing Roads.

18. ***Atlantic Coast Line.***—Projected, end of track south of Sumpter to Augusta, 85 miles.

38. ***Bishopville.***—Under construction, Bishopville north, 20 miles.

39. ***Blackville, Alston & Newberry.***—Under construction, Barnwell to Allendale, 17 miles. Projected, Seivern to Batesburg, 16 miles.

40. ***Carolina, Cumberland Gap & Chicago.***—Under construction, Edgefield to Abbeville, 40 miles. Projected, Abbeville to Asheville, N. C., 85 miles.

41. ***Carolina, Knoxville & Western.***—Partly graded, Augusta to Greenville, 106 miles. Located, Marietta to Knoxville, Tenn., 148 miles. Jas. J. Williams, Greenville.

20. ***Charleston, Cincinnati & Chicago.***—Partly graded, Blacks to Augusta, Ga., 151 miles.

42. ***Charleston, Sumter & Northern.***—Track laid in 1890, Eutawville to Pine Bluff, 6 miles; Bennettsville south, 6 miles. Track laid since January 1, 1891, Sumter toward Bennettsville, 47.2 miles. Under construction, end of track to Bennitsville, 14.5 miles.

43. ***Columbia, Newberry & Laurens.***—Track laid in 1890, Broad River to Jalapa, 49 miles; track laid since January 1, 1891, Jalapa to Dover, 13.5 miles.

East Shore Terminal.—Track laid in 1890, terminal line at Charleston, 3 miles.

44. ***Georgia, Carolina & Northern.***—Track laid in 1890, Chester to Savannah River, 110 miles.

45. ***South Bound.***—Track laid in 1890, Savannah, Ga., to Monteith, Ga., 12 miles; track laid since Jan. 1, 1890, Monteith, Ga., to the Savannah River, 19 miles; Campbellton to Giffords, 7 miles. Under construction, Giffords to the Savannah River, 29 miles; Campbellton to Columbia, 75 miles. Chief Engineer, Geo. Dole Wadley, Savannah, Ga.

Projects and Surveys.

46. ***Bennettsville & Society Hill.***—Surveyed, Bennettsville to Society Hill, 11 miles. Chief Engineer, Thos. S. Lucas, Society Hill.

47. ***Cape Fear & Cincinnati.***—Under survey, Southport, N. C., to Greenville, 275 miles. Chief Engineer, Geo. B. Newton, Baltimore, Md.—Asheville, Atlanta & Knoxville R. R.—Under contract, Gaffney City to Broad River, 25 miles. Surveyed, Broad River to Camden, 60 miles.

48. ***Carolina Southern.***—Surveyed, Cheraw to Sumter, 65 miles. President, W. G. Childs, Columbia; Chief Engineer, Wm. Moncure, Durham.

49. ***Spartanburg, Glendale & Clifton.***—Projected, Spartanburg to Clifton, 10 miles. J. C. Cleveland, Spartanburg.

50. ***Walterboro & Yemassee.***—Projected, Yemassee to Pregnals, 40 miles. President, R. C. Buckley, Charleston; Chief Engineer, Gordon Gairdner, Augusta, Ga.

Total.—Track laid in 1890, 174 miles. Track laid since Jan. 1, 1891, 68 miles. In process of construction, 478 miles. Surveyed or under survey, 406 miles. Projects of some promise, 316 miles.

GEORGIA.—Existing Roads.

51. ***Abbeville & Way Cross.***—Track laid in 1890, Abbeville to Bowen's Mill, 13 miles. Partly graded, Bowen's Mill to Swan's, 10 miles. Under survey, Abbeville to Fort Valley, 60 miles. Chief Engineer, F. C. Hand, Abbeville.

52. ***Albany, Florida & Northern.***—Track laid in 1890, Albany toward Cordele, 20 miles. Track laid since Jan. 1, 1890, end of track to Cordele, 15 miles.

53. ***Augusta & West Florida.***—Under construction, Augusta to Lonisville, 50 miles. Projected, Blackville to Thomasville, 160 miles. President, C. E. Smith; Secretary, J. P. Verdery, both of Augusta.

54. ***Cartersville & Gainesville.***—Partly graded, Chattahoochee River to Dawsonville, 23 miles. Located, Dawsonville to Cartersville, 46 miles. Chief Engineer, Parker N. Black, Atlanta.

55. ***Central R. R. of Georgia.***—Track laid in 1890, Pembroke to Lyons, 42.75 miles. Under survey, Ellabel to Oconee, 110 miles.

56. ***Chattanooga, Rome & Columbus.***—Projected, Carrollton to Columbus, 101 miles.

57. ***Chattanooga Southern.***—Track laid in 1890, Tennessee line to Pigeon Mt., 27 miles.

58. ***Cincinnati, Georgia & Florida.***—Surveyed, Harrison, Tenn., to Kensington, 50 miles. President, F. S. Vaughan, Gaysville.

59. ***Columbus Southern.***—Track laid in 1890, Weston to Albany, 39.68 miles.

60. ***Dover & Statesboro.***—Projected, Statesboro to Reidsville, 40 miles. President, Fred. Lockhart, Augusta.

61. ***East Tennessee, Virginia & Georgia.***—Projected, Hazlehurst to Way Cross, 40 miles.

62. ***Empire & Dublin.***—Partly graded, Hawkinsville to Grovania, 13 miles; end of track to Dublin, 5 miles. Surveyed, Grovania to Fort Valley, 19 miles.

63. ***Flovilla & Indian Springs.***—Track laid since June 6, 1891, Flovilla to Indian Springs, 8 miles.

64. ***Georgia, Carolina & Northern.***—Track laid since Jan. 1, 1891, Savannah River toward Athens 25 miles. Under construction, end of track to Atlanta, 85 miles.

64. ***Georgia, Midland & Gulf.***—Track laid in 1890, in city of Columbus, 1.25 miles. Projected, McDonough to Athens, 98 miles.

65. ***Georgia Southern & Florida.***—Under construction, Tifton to Thomasville, 52.8 miles.—Macon & Birmingham R. R.—Track laid in 1890, Macon to La Grange, 95 miles. Surveyed, La Grange to Birmingham, Ala., 135 miles.—Macon & Atlantic R. R.—Track laid since Jan. 1, 1891, Bruton east, 12 miles. Under construction, Macon to Bruton, 45 miles; joint 12 miles east of Bruton to Seacoast, 123 miles.

66. ***Macon, Dublin & Savannah.***—Track laid in 1890, Macon toward Dublin, 10 miles. Track laid since Jan. 1, 1891, end of track to Dublin, 34 miles. Graded, end of track to Dublin, 10 miles. Projected, Dublin to Savannah, 120 miles. Chief Engineer, D. B. Dunn, Macon.

67. ***Marietta & North Georgia.***—Surveyed, Marietta to Atlanta, 20 miles.

68. ***Middle Georgia & Atlantic.***—Track laid in 1890, Eatonton to Newburn, 32 miles. Partly graded, Newburn to Covington, 6 miles; Newburn to Social Circle, 10 miles. Projected, Eatonton to Savannah, 170 miles. Chief Engineer, L. W. Robert, Monticello.

69. ***Millin & Southern.***—Graded, Thrift to Millin, 11 miles.

70. ***Savannah, Americus & Montgomery.***—Track laid in 1890, Oconee River to Lyons, 20 miles; Louvale to Alabama line, 13.63 miles.

71. ***Smithsonia & Dunlap.***—Track laid in 1890, Dunlap to Smithsonia, 10 miles.

Wadley & Mt. Vernon.—Track laid in 1890, Gay to Rixville, 12 miles.

72. ***Way Cross Air Line.***—Track laid in 1890, Way Cross west, 24 miles. Partly graded, St. Marys to Way Cross, 50 miles. Surveyed, end of track to Cordele, 70 miles. Chief Engineer, J. T. Stone, Cordele.

73. ***Wrightsville & Tinnile.***—Surveyed, Dublin to Abbeville, 45 miles.

Projects and Surveys.

74. ***Albany, Georgia & Florida.***—Surveyed, Bessemer, Ala., to Quincy, Fla., 280 miles. Chief Engineer, W. S. Green, Columbus.

75. ***Albany, Boston & Florida.***—Projected, Albany to Boston, 90 miles; President, M. R. Mallette, Boston.

76. ***Atlanta & Columbia.***—Surveyed, Atlanta to Selma, 180 miles. President, H. B. Tomkins, Atlanta; L. E. O'Keefe, Atlanta.

77. ***Atlanta & Birmingham.***—Projected, Atlanta to Helena, Ala., 160 miles. Thos. C. Crenshall, Atlanta.

78. ***Atlanta & Northwestern.***—Projected, Augusta to Chattanooga, Tenn., 240 miles. President, R. M. Mitchell, Augusta; Allen D. Chandler, Gainesville.

Atlanta Belt.—Projected, belt line railway at Atlanta, 5 miles.

79. ***Bellton, Homer & Carnesville.***—Surveyed, Bellton to Carnesville, 30 miles. President, M. Bruce, Covington; vice-president, L. N. Tribble, Carnesville.

80. ***Dahlonega & Dawsonville.***—Surveyed, Tate to Lulu Junction, 65 miles. President, P. B. Lawrence, Dahlonega; Frank W. Hall, Dahlonega.

81. ***Georgia Northern.***—Projected, Dalton to Ball Ground, 45 miles.

82. ***Georgia, Tennessee & Illinois.***—Surveyed, Tallapoosa to Stevenson, Ala., 125 miles.

83. ***Macon & Northeastern.***—Projected, Macon to Elberton, 100 miles.

Macon Terminal.—Projected, belt line at Macon, 3 miles.

84. ***South Florida & Georgia Air Line.***—Projected, Quitman to Tampa, Fla., 220 miles. Joseph Quitman, Quitman.

85. ***Talbotton & Western.***—Projected, Waverly Hall to Flint River, 30 miles. W. H. Martin, Talbutton.

86. ***Thomasville Southern.***—Surveyed, Thomasville to Tallahassee, Fla., 35 miles. P. S. Montgomery, Thomasville.

Total.—Track laid in 1890, 372.34 miles. Track laid since Jan. 1, 1891, 120 miles. In process of construction, 709 miles. Surveyed or under survey, 885 miles. Projects of some promise, 1,647 miles.

FLORIDA—Existing Roads.

87. ***Atlantic, Gulf & Havana.***—Partly graded, St. Augustine south, 15 miles. Located, end of grade to New Smyrna, 50 miles. Surveyed Daytona to De Land, 20 miles.

88. ***Florida Central & Peninsular.***—Track laid in 1890, Tampa to Plant City, 22.84 miles.

89. ***Florida, Midland & Georgia.***—Graded Valdosta Ga., to Florida line, 15 miles. Located, Florida line to Deadman's Bay, 70 miles. Chief Engineer, Arthur Pew, Valdosta, Ga.

90. ***Gainesville, Tallahassee & Western.***—Under construction, Tallahassee east, 25 miles. Under survey, end of grade to Gainesville, 115 miles. Chief Engineer, John M. Cook, Gainesville.

91. ***Georgia Southern & Florida.***—Track laid in 1890, mile post 232 to mile post 266, 34 miles.

92. ***Osceola & Lake Jessup.***—Track laid in 1890, Lakemont to Oviedo, 150 miles.

93. ***Palatka & Anclote.***—Partly graded, Palatka to Orange Springs, 25 miles. Surveyed, Orange Springs to Anclote, 100 miles. Chief Engineer, Wm. E. Strong, Palatka.

St. Augustine & North Beach.—Track laid in 1890, St. Augustine to North Beach, 5 miles.

94. ***St. Cloud Sugar Belt.***—Surveyed, Narcosse to Orlando, 24 miles.

95. ***Silver Springs, Ocala & Gulf.***—Track laid since Jan. 1, 1891, Dunnellon to Anita, 9 miles. Under construction, Anita south, 25 miles. Projected; end of grade to Anclote, 36 miles.

96. ***South Florida.***—Under construction, Phosphate City to Bartow, 7 miles; Pemberton to Dunnellon, 40 miles. Projected, Dunnellon to Savannah, Florida & Western R. R., 60 miles.

97. ***Suwanee River.***—Track laid in 1890; end of track to Hattyburg, 12 miles.

98. ***Tavaris & Gulf.***—Partly graded, Wait's Junction south, 7.5 miles. Projected, end of grade to Punta Gorda, 167 miles.

99. ***West Florida & Alabama.***—Partly graded, Chipley to St. Andrews, 45 miles. President, J. W. Perrong, Wewahitchka.

100. ***Western Ry. of Florida.***—Projected. Melrose to Rochelle, 12 miles.

Projects and Surveys.

101. ***Ocala & Silver Springs.***—Projected, Ocala to Silver Springs, 6 miles.

102. ***Orlando & Oakland.***—Projected, Orlando to Oakland, 15 miles. President, Mahlon Gore, Orlando.

103. ***Palatka & Lake Shore.***—Projected, Apopka to Palatka, 80 miles. Chief Engineer, E. B. Patten, Windermere.

104. ***St Johns & Santa Fe.***—Projected, Jacksonville to Fort White, 75 miles. J. A. Bryan, Middleburg.

Total.—Track laid in 1890, 78.84 miles. Track laid since Jan. 1, 1891, 9 miles. In process of construction, 190 miles. Surveyed or under survey, 499 miles. Projects of some promise, 656 miles.

ALABAMA.—Existing Roads.

105. ***Alabama Midland.***—Track laid in 1890, near Troy to end of track, 22 miles.

106. ***Birmingham & Jones Valley.***—Track laid in 1890, Birmingham to Avondale, 2 miles. Under construction, Avondale to Springville, 25 miles. Projected Springville to Gadsden, 30 miles. Chief Engineer, C. O. Lagerfelt, Birmingham.

107. ***Birmingham, Sheffield & Tennessee River.***—Track laid in 1890, Jasper to Georgia Pacific Ry., 9 miles; Margerum to Riverton, 11 miles. Surveyed, Sheffield to Riverton, 25 miles; South Parrish to Warrior River, 20 miles.

108. ***Blue Mountain Mineral.***—Partly graded, Anniston to Jacksonville, 15 miles.

55. ***Central R. R. of Georgia.***—Mobile & Girard R. R.—Track laid since Jan. 1, 1891, Troy south, 30 miles. Graded, end of track to Saginaw, 21 miles. Projected, Saginaw to Brewton, 40 miles.

57. ***Chattanooga Southern.***—Track laid in 1890, Gadsden north, 12 miles. Track laid since Jan. 1, 1891, end of track to Pigion Mt., Ga., 47 miles.

109. ***Dauphin Island.***—Partly graded, Mobile south, 8 miles. Surveyed, end of grade to Dauphin Island, 28 miles. H. A. Austill, Mobile.

110. ***Dayton & Faunsdale.***—Partly graded, Dayton to Faunsdale, 8.5 miles.

111.—***Decatur, Chesapeake & New Orleans.***—Track laid in 1890, Tennessee line south, 11 miles; Decatur north, 1 mile. Under construction, between Decatur and Tennessee line, 18 miles. Projected, Decatur to Aberdeen, Miss., 110 miles.

61. ***East Tennessee, Virginia & Georgia.***—Track laid in 1890, Savage Creek to Blocton, 12 miles; Gurnee to Bessemer, 18 miles. Projected, Attalla to Decatur, 70 miles; Mobile to Pearl River, Miss., 110 miles.

112. ***Escambia.***—Track laid in 1890, Sullivan north, 27 miles. Under survey, Sterdham to Little River, 7 miles. President, M. H. Sullivan, Flouraton.

113. ***Florence Northern.***—Graded, Florence north, 27 miles. Surveyed, end of grade to Linden, Tenn., 50 miles. President, W. B. Wood; Chief Engineer, A. G. Negley; both of Florence.

114. ***Fort Payne & Eastern.***—Projected, end of track to Rome, Ga., 30 miles.

Gadsden & Attalla Union.—Track laid in 1890, Gadsden to Belle View Highlands, 12 miles.

115. ***Georgia Pacific.***—Track laid in 1890, North Birmingham to Coalburg, 7 miles.

116. ***Jacksonville, Mining & Manufacturing Co.***—Under construction, Tredgar to Iron Mt., 9.5 miles.

117. ***Kansas City, Memphis & Birmingham.***—Under construction, branch to Bessie mines, 3 miles.

118. ***Louisville & Nashville.***—Track laid in 1890, Boyles to Birmingham, 2.09 miles; Helena to Gurnee 10 miles; Red Gap to Graces, 10.09 miles; Milldale to mines, 5 miles; Sylacauga to Calera, 30 miles. Under construction, belt line at Decatur, 2 miles. Surveyed, Sylacauga to Watumpka, 50 miles. Projected, Pine Apple to Repton, 35 miles.

119. ***Mobile & Ohio.***—Under survey, Corinth, Miss., to Birmingham, 150 miles.

120. ***Montgomery, Tuscaloosa & Memphis.***—Track laid in 1890, Montgomery west, 0.5 miles. Under construction, Montgomery to Tuscaloosa, 107 miles. Projected, Tuscaloosa to Mobile & Ohio R. R., 60 miles.

121. ***Nashville, Chattanooga & St. Louis.***—Track laid in 1890, Littleton toward Guntersville, 19 miles. Under construction, end of track to Guntersville, 6 miles. Under survey, Smithville to Bell Factory, 40 miles.

122. ***Ohatchie Valley.***—Track laid in 1890, Laney to J. C. mines, 4 miles. Track laid since Jan. 1,1891, Burnesville to mines, 1 mile; branch to Lyon's mines, 1.5 miles. Projected, Lyon's mines to Piedmont, 12 miles.

123. ***Rutledge & Julien.***—Partly graded, Rutledge to Julien, 4 miles.

70. ***Savannah, Americus & Montgomery.***—Track laid in 1890, Hurtsboro east, 8 miles. Track laid since Jan. 1, 1891, Hurtsboro west, 45 miles. Graded, end of track to Montgomery, 15 miles. Under construction, end of track to Chattahoochee River, 12 miles.

124. ***Seaboard Ry. of Alabama.***—Track laid in 1890, Mannahubba to Sims Chapel, 16 miles.

125. ***Talladega & Coosa Valley.***—Track laid in 1890, Renfroe to Cooks, 8 miles.

126. ***Tennessee River, Ashville & Coosa.***—Track laid in 1890, Ashville to Whitney, 3.91 miles. Located, Ashville to Coosa River, 8 miles; Whitney to Cullam, 40 miles. Chief Engineer, T. M. S. McKennan, Ashville.

Projects and Surveys.

127. ***Anniston & Montgomery.***—Surveyed, Anniston to Montgomery, 110 miles. Chief Engineer, C. C. Wrensnall, Annistown.

128. ***Birmingham, Mobile & Navy Cove Harbor.***—Projected, Mobile to Navy Cove, 35 miles. C. S. Bushnell, 35 Broadway, New York City.

129. ***Columbia, Geneva & Western.***—Surveyed, Columbia to Geneva, 50 miles. President, John T. Davis; Chief Engineer, H. L. Collier, both of Columbia.

130. ***Florence & Mobile.***—Under survey, Florence to Mobile, 30 miles.

131. ***Gadsden, Shelby & Montgomery.***—Projected, Gadsden to Montgomery, 175 miles. Secretary, C. E. Payne, Birmingham.

132. ***Gurley & Paint Rock Valley.***—Located, Winchester, Tenn., to Deposite, 65 miles. President, F. B. Gurley, Gurley.

133. ***Mobile Transportation Co.***—Projected, Mobile to Portersville, 36 miles. R. K. Warren, Mobile.

134. ***Stevenson, Sand Mt. & Dalton.***—Surveyed, Bridgeport to Oneonta, 80 miles. President, G. J. Hall; Chief Engineer, R. A. Bowie, both of Stevenson.

Total.—Track laid in 1890, 257.99 miles. Track laid since Jan. 1, 1891, 118 miles. In process of construction, 211 miles. Surveyed or under survey, 1,500 miles. Projects of some promise, 798 miles.

MISSISSIPPI.—Existing Roads.

115. ***Georgia Pacific.***—Track laid in 1890, Itta Bena to Webb, 34.7 miles. Surveyed, Webb to Helena, Ark., 45 miles.

135. ***Gulf & Ship Island.***—Track laid in 1890, Biloxi River to Iberville, 4.5 miles. Partly graded, end of track to Hatteesburg, 51 miles. President, W. H. Hardy, Meridian; Chief Engineer, W. W. Hungerford, Gulfport.

117. ***Kansas City, Memphis & Birmingham.***—Projected, Aberdeen to Columbus, 28 miles.

136. ***Louisville, New Orleans & Texas.***—Track laid in 1890, Clarksdale to Minter City, 30.6 miles. Projected, Minter City to Yazoo City, 65 miles.

137. ***Meridian.***—Track laid in 1890, Meridian to Bonita Park, 2.5 miles.

138. ***New Orleans & Northwestern.***—Track laid in 1890, Magnolia Station to Natchez, 3 miles.

137. ***Poplar Springs, Handley's Lake & Meridian.***—Track laid in 1890, Meridian to Poplar Springs, 2.5 miles.

Projects and Surveys.

139. ***Helena, Tupelo & Decatur.***—Projected, Helena, Ark., to Decatur, Ala., 210 miles. President, J. L. Finley; Secretary, H. C. Medford; both of Tupelo.

140. ***Memphis & Atlantic.***—Surveyed, Memphis, Tenn., to Tuscaloosa, Ala., 224 miles. President, F. M. Abbott; Chief Engineer, Belton Mickle, both of West Point.

141. ***Mississippi Central Valley.***—Surveyed, Rosedale to Bogue Phalia, 6.5 miles. President, Chas. Scott; Chief Engineer, R. B. Eggleson, both of Rosedale.

142. ***Mobile, Jackson & Kansas City.***—Located, Mobile, Ala., to Jackson, 184 miles. President, H. Austill; Chief Engineer, T. W. Nichol, both of Mobile.

143. ***Nashville & Mississippi Delta.***—Surveyed, Okolona to Granada, 60 miles. Chief Engineer, John S. Foster, Okolona.

144. ***Tombigbee.***—Surveyed, Columbus to Decatur, Ala., 132 miles. President, B. C. Vaughan; Chief Engineer, A. G. Dancy, both of Columbus.

Total.—Track laid in 1890, 86.8 miles. In process of construction, 51 miles. Surveyed or under survey, 491 miles. Projects of some promise, 338 miles.

TENNESSEE.—Existing Roads.

145. ***Bristol, Elizabethtown & North Carolina.***—Under construction, Bristol to Elizabethtown, 20 miles. Projected, Elizabethtown to Mountain City, 25 miles. Elizabethtown to Irwin, 20 miles.

20. ***Charleston, Cincinnati & Chicago.***—Track laid in 1890, Johnson City to North Carolina line, 23 miles; Johnson City north, 14 miles. Under construction, end of track to Minneapolis, Va., 76 miles.

146. ***Cincinnati, Alabama & Atlantic.***—Projected, Huntsville, Ala., to Tullahoma, 55 miles. President, M. R. Campbell, Tullahoma.

111. ***Decatur, Chesapeake & New Orleans.***—Track laid in 1890, Shelbyville south, 2 miles. Under construction, Lincoln Co. line to 2 miles south of Shelbyville, 13 miles. Projected, Shelbyville to Nashville, 50 miles. Chief Engineer, W. H. Calhoun, Fayetteville.

147. ***East Tennessee Land Co.***—Harriman Belt R. R.—Track laid in 1890, belt line at Harriman, Tenn., 2.4 miles. Track laid since Jan. 1, 1891, belt line extension, 2 miles. Under construction Drummond's Station to Bushy Mt., 14 miles. Surveyed, Harriman to Kingston, 9 miles. President, Thos. L. James, New York City. Chief Engineer, J. P. Suverkrop, Harriman.

61. ***East Tennessee, Virginia & Georgia.***—Johnson City and Carolina R. R.—Track laid in 1891, Johnson City toward Embreeville, 5 miles. Track laid since Jan. 1, 1891, end of track to Embreeville, 11 miles.—Projected, Rogersville to Big Stone Gap, Va., 45 miles.

148. ***Genesis & Obed River.***—Johnson's Stand toward Crossville, 3 miles. Partly graded, end of track to Crossville, 18.5 miles.

149. ***Knoxville Southern.***—Track laid in 1890, between Georgia line and Knoxville, 80 miles.

118. ***Louisville & Nashville.***—Track laid since Jan. 1, 1891, Pond's Station to Van Leer, 10 miles; Van Leer to Cumberland Furnace, 6 miles. Under construction, Van Leer to Clarksville, 21 miles. Projected, Summertown to Waynesboro, 36 miles.

150. ***Middle & East Tennessee Central.***—Track laid in 1890, Huntsville to Huntsville Junction, 11.5 miles.

151. ***Morristown & Cumberland Gap.***—Under construction, Morristown to Corryton, 44 miles. President, J. G. Martin; Chief Engineer, T. J. Mosier; both of Morristown.

152. ***Nashville & Knoxville.***—Track laid in 1890, Caney Fork River to Cookeville, 22 miles. Under contract, Cookeville to Cumberland Plateau, 18 miles. Located, Cumberland Plateau to Glen Alice, 37 miles; Cumberland Plateau to Hanging Limb, 15 miles.

121. ***Nashville, Chattanooga & St. Louis.***—Track laid in 1890, Dunlap to Pikeville, 20 miles.

153. ***Paducah, Tennessee & Alabama.***—Track laid since Jan. 1, 1891, Hazel to Paris, 15.7 miles. Under contract, Paris to Hollow Rock, 22.8 miles. Chief Engineer, N. R. Olcott, Paris.

154. ***Paint Rock Coal & Coke.***—Track laid in 1890, Oneida to mines, 4.5 miles.

155. ***Raleigh Springs.***—Located, Memphis to Raleigh, 11 miles. President, John T. Ferguson, Memphis.

156. ***Tennessee Midland.***—Located, Perryville to Nashville, 92 miles.

157. ***Watauga Valley.***—Graded, Watauga to Watauga Point, 5 miles. Projected, Watauga Point to Cranberry, 35 miles.

Projects and Surveys.

158. ***Birmingham, Jackson & Kansas City.***—Projected, Jackson to Fowlks, 45 miles. President, Clifton Dancey; Chief Engineer, J. J. Williams; both of Jackson.

159. ***Carolina, Greenville & Northern.***—Surveyed, Estillville, Va., to Hot Springs, N. C., 83 miles. President, C. G. Rankin; Chief Engineer, R. A. Bowie; both of Greenville.

160. ***Chattanooga, Cleveland & Murphy.***—Under survey, Cleveland to Toccoa, Ga., 99 miles. President, Henry E. Colton, Chattanooga; Chief Engineer, John M. Blackburn, Sequachee.

161. ***Hellenwood & Middlesborough.***—Projected, Hellenwood to Middlesborough, Ky., 60 miles. Ridgeway, Sprankle & Co., Hellenwood.

162. ***Johnson City & Greensboro.***—Projected, Allentown to Lenoir, N. C., 50 miles. President, Frank A. Stratton; Chief Engineer, Henry E. Colton; both of Johnson City.

163. ***Missouri, Tennessee & Georgia.***—Surveyed, Hickman, Ky., to Humboldt, 85 miles.

Total.—Track laid in 1890, 187.4 miles. Track laid since Jan. 1, 1891, 45 miles. In process of construction, 222 miles. Surveyed or under survey, 554 miles. Projects of some promise, 356 miles.

KENTUCKY.—Existing Roads.

Chesapeake & Ohio.—Track laid in 1890. Kinneconnick to quarries, 9 miles; Hawksnest to mines, 4 miles.

Kentucky Midland.—Surveyed, Paris to Morgan Co. line, 70 miles.

Kentucky Union.—Track laid in 1890, Kentucky River to near Jackson, 23 miles; Lexington to Winchester, 20 miles.

164. ***Knoxville, Cumberland Gap & Louisville.***—Track laid in 1890, Cumberland Gap to Middlesborough, 13.75 miles.

Lexington Belt.—Track laid in 1890, at City of Lexington, 5 miles.

Louisville, St. Louis & Texas.—Track laid in 1890, end of track to Fordsville, 13 miles. Fisher's Junction to Falls of Rough, 4.4 miles.

Louisville Southern.—Track laid in 1890, Versailles to Richmond, 39.86 miles. Under construction, Richmond to Irvine, 23.36 miles. Located, Irvine to Beattyville, 34.96 miles. Projected, Beattyville to West Virginia line, 85 miles.

Middlesborough Belt.—Track laid in 1890, belt around city of Middlesborough, with branches, 16.4 miles. Under construction, extension of branches, 9.5 miles.

Ohio & Big Sandy.—Surveyed, Louisa to Norfolk & Western R. R., 40 miles.

Owensboro, Falls of Rough & Green River.—Track laid in 1890, Fair Grounds to Louisville, St. Louis & Texas R. R., 0.5 miles.

153. ***Paducah, Tennessee & Alabama.***—Track laid in 1890, Paducah to Tennessee line, 49.1 miles.

Projects and Surveys.

165. ***Bowling Green & Northern.***—Located, Grayson's Springs Station to Chesapeake, Ohio & Southwestern R. R., 75 miles. Secretary, M. H. Crump, Bowling Green.

166. ***Burkesville & Northeastern.***—Surveyed, Burkesville to Horse Cave, 46 miles. President, W. F. Alexander; Chief Engineer, H. A. Quincy; both of Burkesville.

167. ***Charleston, Kentucky & Western.***—Projected, Newport to Cumberland Gap, 180 miles. President, A. Baum, Mt. Sterling.

168. ***Chicago, Evansville & Chattanooga.***—Surveyed, Evansville to Bowling Green, 90 miles. Chief Engineer, A. B. Fitch, Terra Haute, Ind.; J. E. Williams, Evansville, Ind.

169. ***Cumberland Gap & Mississippi Valley.***—Projected, Columbus to Hopkinsville, 90 miles. President, Jos. F. Hoard; Secretary, Hunter Wood; both of Hopkinsville.

Cynthiana & Western.—Surveyed, Georgetown to Maysville, 55 miles.

170. ***Kentucky & Cumberland.***—Surveyed, Frankfort to Sparta, Tenn., 140 miles.

Hartford & Fordsville.—Surveyed, Hartford to Fordsville, 19 miles. President, T. J. Smith, Hartford.

171. ***Jellico, Beattyville & Ashland.***—Projected, Jellico to Beattyville, 80 miles. President, C. F. Davidson, Jellico.

Louisville Southeastern.—Projected, Louisville to Smithville, 25 miles. President, W. B. Hoke, Louisville.

Total.—Track laid in 1890, 198 miles. In process of construction, 33 miles. Surveyed or under survey, 520 miles. Projects of same promise, 465 miles.

WEST VIRGINIA.—Existing Roads.

Baltimore & Ohio.—Partly graded. Morgantown to Uniontown, Pa., 33 miles.

Chesapeake & Ohio.—Track laid in 1890. Coalburg to Cabin Creek, 15 miles. Projected, Warren Springs, Va., to Gauley Bridge, 90 miles.

Huntington & Big Sandy.—Track laid in 1890, Huntington to Kenova, 5 miles. Track laid since Jan 1, 1891, end of track to Big Sandy River, 7 miles.

Kanawha.—Track laid in 1890, Fairfield to Acme, 9.5 miles.

Monongahela River.—Track laid in 1890, Shinnston to Clarksburg, 15 miles.

Norfolk & Western.—Track laid since Jan. 1, 1891, on Elkhorn Extension, 40 miles. Under construction, between Elkhorn and Ironton, O., 155 miles.

Ohio River.—Track laid since Jan. 1, 1891, Ravenswood east, 10 miles. Under construction, end of track to Spencer, 23 miles.

St. Albans & Coal River.—Under contract, St. Albans to Madison, 42 miles. President, M. P. O'Herne; Chief Engineer, W. C. Reynolds, both of Charleston.

Western Maryland.—Under construction, Williamsport, Md., to Cherry Run, 14.2 miles.

West Virginia & Pittsburg.—Track laid in 1890, Buckhannon to Shelbyville, 25 miles; Weston to Barnesville, 26 miles. Track laid since Jan. 1, 1891, Barnesville to Braxton, 18 miles. Under construction, Braxton to Gauley River, 29 miles; Newton to Florence, 9.0 miles.

West Virginia Central & Pittsburg.—Under construction, Elkins to Beverly, 7 miles; Elkins to Belington, 17 miles. Under survey, Beverly to Covington, Va., 103 miles. Projected, Cumberland to Williamsport, Md., 84 miles.

Projects and Surveys.

Bayard, Petersburg & Moorefield.—Under survey, Bayard to Moorefield, 40 miles.

Berryville & Summit Point.—Projected, Summit Point to Berryville, Va., 10 miles. C. B. Wilson, A. B. Thompson; both of Summit Point.

Bluefield & Princeton.—Surveyed, Bluefield to Princeton, 10 miles. Chief Engineer, H. S. Lamble, Roanoke, Va.

Charleston, Glendennin & Southern.—Projected, Charleston to Sutton, 55 miles.

Greenbrier & Gauley.—Projected, Alderson to Gauley River, 35 miles. Wm. P. Smith, Charleston.

New River & Kanawha.—Projected, Loup Creek up Arbuckle Creek, 60 miles. J. H. Gaines, Fayetteville.

Pennsboro, Harrisville & Ritchie Co.—Projected, Ritchie C. H. to Glenville, 25 miles.

Pittsburg, Washington & Southern.—Under survey, Blacksville to Clarksburg, 30 miles. President, T. M. Jackson, Clarksburg.

West Virginia & Kanawha.—Projected, St. Albans up Coal River, 60 miles. Chas. A. Draper, Exchange Place, New York City.

Wheeling & Connellsville.—Projected, Wheeling to Connellsville, Pa., 60 miles. W. A. Lynch, Canton, O.; James B. Laury, Wheeling.

Total.—Track laid in 1890, 95.5 miles. Track laid since Jan. 1, 1891, 75 miles. In process of construction, 305 miles. Surveyed or under survey, 161 miles. Projects of some promise, 328 miles.

The Railways of the World.

The last number of the *Archiv fur Eisenbahnwesen* contains a statement of the growth of the railways of the world from 1885 to the end of 1889. As will be seen from the following table, prepared from the figures in our contemporary, the total length of the railways at the close of the last decade amounted to 370,193 miles, equal to nearly 15 times the equatorial circumference of the world and more than 124,000 miles in excess of the mean distance of the moon from the earth. On Dec. 31, 1879, the length of the lines in actual operation was 211,202 miles, and the increase in the last 10 years has therefore been 75.3%. If a similar increase takes place in the present decade, the mileage at the beginning of the twentieth century will be more than 520,000.

America contributed the greatest number of miles of road during the 4 years under consideration, and especially the United States, where the growth amounted to 25.1%. Canada and Mexico also show heavy gains.

After America comes Europe, with 12.6%. Of the various countries there, Germany shows the greatest increase, followed by Austria, France, Russia and Italy.

In Asia, British India has developed the greatest activity, and its lines have increased 32%. In densely peopled China no long line is yet built, but the proposed trans-Siberian road of the Russian government may result in increased construction.

In Africa the only marked increase has been in Algiers and Tunis, but a comparatively rapid development may be expected when the conflicting claims of Germany and England are settled, and the interior, as well as the Congo basin, is more settled.

The Australian systems have extended rapidly, especially in South Australia and Queensland. It is interesting to note that West Australia has the greatest mileage in proportion to its population of any country.

THE RAILWAYS OF THE WORLD.

COUNTRY.	LENGTH, MILES.		INCREASE, PER CENT.	LENGTH, MILES (1889).	
	1885.	1889.		Per 100 Sq. M.	Per 10,000 Inhab.
Prussia	13,889	15,515	11.7	11.5	5.3
Bavaria	3,161	3,368	6.6	11.4	6.2
Saxony	1,329	1,479	8.0	25.5	6.4
Würtemberg	890	932	4.0	12.3	4.6
Baden	827	890	7.6	15.2	5.5
Alsace-Lorraine	837	915	9 3	16.2	5.9
Other German states	2,367	2,871	21.3	14.1	5.8
Total, Germany	23,346	25,970	11 2	12.3	5.4
Austria-Hungary, including Bosnia	14,051	16,467	17 2	6.2	3.9
Great Britain and Ireland	19,165	19,939	4.0	16.3	5.2
France	20.189	22,586	11.9	11.1	5.9
Russia, including Finland	16,682	18,728	12.3	1.0	1.9
Italy	6,515	8,117	24 6	7.0	2.6
Belgium	2,740	3,215	17.4	28 0	5.3
Holland, including Luxemburg	1,740	1,887	8.5	13.6	4.0
Switzerland	1,773	1,929	8.8	12.0	6 6
Spain	5,551	6,127	10.4	3.0	3.5
Portugal	950	1,280	34.7	3.7	3.0
Denmark	1,207	1 223	1.4	8.2	5.6
Norway	971	971	.....	0.8	4.9
Sweden	4,283	4,915	14.8	2.9	10.3
Servia	239	326	36.6	1.8	1.6
Roumania	1,045	1,580	51.2	3.2	2.9
Greece	201	440	119.2	1.6	2.0
European Turkey, bulgavia, Roumelia	866	1,097	36.6	1.0	1.4
Malta, Jersey, Man	63	68	7.8	.....	.....
Total, Europe	121,577	136,865	12.6	3.7	3.9
United States	128,941	161,364	25.1	5 6	24.8
Canada	10,117	13,322	31.3	0.5	30.3
Newfoundland	90	115	27.6	0.3	5.8
Mexico	3,480	5,344	53.6	0.6	4.6
Central America	384	559	45.6	0.3	1.9
Cuba	994	1,056	6.3	2.2	7.0
Dominica	50	72	43.8	0 3	1.2
Porto Rico	11	11	.....	0.3	.....
Jamaica, Barbadoes, Trinidad, Martinique	142	294	107.9	.....	.....
Total, North America	144,239	182,137	26.3	.....	.....
Colombia	165	231	40.	.....	0.6
Venezuela	95	441	363.4	.....	1.9
Brazil	4,388	5,779	31.7	0.16	4.0
Argentine Republic	3,408	5,129	50.5	0.5	13.4
Paraguay	45	149	233.3	0.16	4.5
Uruguay	311	470	51.4	0.6	6.8
Chili	1,305	1,925	47.6	0.6	7.1
Peru	813	994	22.2	0.16	3.8
Bolivia	43	106	144.3	.....	0.9
Ecuador	43	167	289.9	0.16	1.6
British Guiana	22	22	.....	.....	.....
Total, South America	10,638	15,413	44.8	.....	.....
British India	11,908	15,838	32.0	1.1	0.6
Ceylon	180	180	.....	0.8	0.6
Asia Minor	231	447	93.5	.....	.....
Asiatic Russia	310	890	186.6	0.5	20.7
Persia	.....	11	.....	.....	.....
Dutch Indies	715	797	11.6	1.6	0.4
Japan	348	907	161.2	0.6	0 25
Malay States	8	31	284.6	.....	.....
China	7	124	1718.2	.....	.....
Cochin China and Pondicheri	52	52	.....	.....	.....
Total, Asia	13,849	19,277	39 2	.....	.....
Egypt	932	957	2.7	.....	.....
Algeria and Tunis	1,281	1,923	50.1	0.8	3.6
Cape Colony	1,736	1,785	2.9	0.8	13.0
Natal	116	234	102.1	1.3	4.9
South African Republic	.....	50	.....	.....	.....
Mauritius, Reunion	.....	.....	.....	.....	.....
Senegal	305	416	36.2	.....	.....
Total, Africa	4,370	5,365	22.8	.....	.....
New Zealand	1,654	1,905	15.2	1.8	28 3
Victoria	1,676	2,288	36.5	2.6	20.4
New South Wales	1,777	2,252	26.7	0.8	20.2
South Australia	1,063	1,757	65.2	0 16	54.4
Queensland	1,444	2 063	43.8	0.3	50.8
Tasmania	257	374	45.8	1.4	24.8
West Australia	184	497	170.1	.....	112 9
Total, Australia	8,015	11,136	38.3	0.3	29.2
Total, World	302,718	370,193	22.3	.....	.....

PUMPING SEWAGE BY ARTESIAN-WELL POWER is being successfully tried in Jacksonville, Fla. The Board of Public Works of that city have put in a pumping plant to lift the sewage of the lower part of Springfield to the higher sewerage system of the city. The artesian well back of the water-works develops a pressure of 22 lbs. per sq. in. when confined. Near this well a collecting well for sewage was built, of 10,000 galls. capacity, into which the sewage flows by gravity. In this well was then placed a centrifugal pump, belted to a turbine wheel. The latter is connected with the artesian well by an 8-in. pipe, and the sewage is forced through another 8-in. pipe into the upper sewerage system at the rate of 400 galls. per minute. The entire plant cost $1,900 —says the *Florida Times-Union*.

THE FIRST 12-IN. AMERICAN-MADE STEEL GUN is ready for trial at Sandy Hook. It was made at the Watervliet Arsenal, West Troy, N.Y. The gun weighs 52 tons, and is 36.66 ft. long, with 34-ft. length of bore. Its charge will be 440 lbs. of powder, with a projectile of 1,000 lbs. The powder pressure exerted will be 16½ tons per square inch, imparting an initial velocity to the projectile of 1,940 ft. per second, and giving a muzzle energy of 26,000 ft. tons. At the muzzle this shot would penetrate 32 ins. of iron, and penetrate 20 ins. at two miles range. The completion of this gun marks a creditable step in the progress that the government is making in its army gun factory at the Watervliet Arsenal, at West Troy. Gun manufacture was first begun there in November, 1887, under limited and intermittent appropriations. In the two years ending Dec. 31, 1890, the guns completed there comprised fifty 3.2-in. and one 3.6-in. field guns, one 3.6-in. field mortar, one 8-in. and one 10-in. steel seacoast guns, the conversion of a 12-in. muzzle-loading steel-hooped mortar into a breech loader, and rifling and making the breech mechanism for a 10-in. cast-iron wire-wrapped gun. A 12-in. steel seacoast mortar, the first of seventy-four ordered by the government, is now almost completed at the Watervliet Arsenal.

THE TEHUANTEPEC SHIP-RAILWAY PROJECT is being revived. Mr. SIMON STEVENS, late President of the Tehuantepec Railway & Ship Canal Co., is planning a treaty between the United States and Mexico, by the terms of which these two governments would jointly guarantee the issue of $100,000,000 of 2% 100-year bonds for the completion of the ship-railway and canal proposed in the plans. Under present conditions, there is no prospect of a treaty of this character being carried out.

AN EXPERIENCE IN WATER FILTERING.—A remarkable instance of the value of a special water supply is mentioned by the Sheffield correspondent of *The Engineer*, Mr. G. W. HAWKSLEY, the proprietor of the Belle Isle Dye Works, Wakefield. The water supply cost him about $5,000 a year, and as it was likely to cost him more, he set his wits to work to supply himself from the river Calder. He has put up a large tank, 22 ft. long by 12 ft. deep, to receive the water, which he lifts by a double-acting pump from the river. He mixes about 20% of air with it, and then passes it into the large reservoir, through a series of six filters of steel, 4 ft. diameter by about 5 ft. high. He filters the water upwards, and passes it under pressure filtered into the large tank at the top. A difficulty was the large amount of wool and dressings from the mills thrown into the river above his works. He was solaced with the assurance that in a very short time the filters would be silted up. To get over this he had the filters arranged with large asbestos-packed plug taps, by which he could reverse the current in any filter, thereby causing the filtered water from the other five filters to wash out the heavy matter that had been absorbed in the filter bed, thus scouring the filtering material with filtered water. As this wool has a very great tendency to felt up the filtering material into balls, he had to find a remedy. He drained the filters of the water, and then charged each with high-pressure steam. When the filters were thoroughly saturated with high-pressure steam he shut off the supply, and suddenly opened the waste plug tap, by which he got an expansion of steam in all the cocoons of felted matter, which instantly burst, and thus the materials are thoroughly cleansed. By the success of this experiment, Mr. Hawksley estimates his saving at not less than $2,500 a year.

CONSTRUCTION NEWS.

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

Whitefield & Jefferson.—The contract for constructing 27 miles of the proposed extension of this New Hampshire railway has been let to Brown & Ryan, of New York City.

Pittsburgh, Shenango & Lake Erie.—Surveys have been finished for the proposed branch from Conneaut Junction to Conneaut, O., 11 miles, and it is stated that construction will begin soon. It is hoped to have the grading completed this season.

Philadelphia & Reading.—The engineers of this company are locating a line from Glenside to Chestnut Hill, near Philadelphia, a distance of 4 miles. —The contract for building the Tamqua, Hazleton & Northern R. R. from Lofty, Pa., to a connection with the Delaware, Susquehanna & Schuylkill R. R., 12 miles, has been let to Nolan Bros., of Reading, Pa., and A. J. McBean, of Chicago. The work is to be finished by October.

Pennsylvania.—The new Winfield Branch of the Butler Branch has been completed, and trains are now running as far as Boggsville, 6 miles from Freeport, Pa.

Mt. Carmel & Natalie.—Work has been begun on this road from Mt. Carmel to Natalie, Pa., 6 miles. A. B. Cockran, Pottsville, Pa, Chief Engineer.

Rochester & Honeoye.—Broadhead & Hickey, New Ringgold, Pa., have the contract for building this New York railway. It will be 13 miles long, and is intended as a feeder to the Lehigh Valley R. R.

Port Clinton Short Line.—The date for receiving bids for track and tracklaying on 12 miles of this Ohio railway has been extended to June 22. For particulars see advertising pages.

Gettysburg & Chambersburg.—It is expected to have this road completed by July 4. It runs from Conoheague, Pa., to Calledonia, Pa., 6 miles, and theace to Wolf Hill, 4 miles. The roadbed has been graded from Conoheague to Calledonia, and construction is in progress on the remaining 4 miles. Tracklaying will begin at once. Samuel Culbertson, Chambersburg, Pa., Chief Engineer.

Adirondack & St. Lawrence.—The 17 miles of the Herkimer, Newport & Poland R. R. have been changed to standard gage and are in operation. A circular has been issued giving the route of this line. The only part of the route outlined which crosses the State lands is the section between Paul Smith's and De Bar Pond, in Franklin Co. It is stated that work will be carried on in each direction up to these points. Seven contractors, employ about 500 men and 100 teams are at work on the section between De Bar Pond and Malone.

Zanesville & Ohio River.—This railway company will be reorganized under the name of the Ohio & West Virginia Ry. Co., recently chartered in Ohio.

Rockaway Valley.—Tracklaying on the extension of this New Jersey railway has been completed from Peapack to Roxiticus, near Mendham, N. J., and will be completed to Mendham, June 15. The length of the extension is 8 miles. The surveys have been made and right of way secured for the extension from Mendham to Morristown, N. J., about 7 miles, and it is expected to have the line completed this season.

Pemigewassett Valley.—There is talk of extending this New Hampshire Ry. from North Woodstock to the Profile House, about 10 miles.

Montreal & Ottawa.—This company will receive bids for grading in 5 mile sections on its line from Rigund to Ottawa, Ont., 75 miles. J. M. Shanley, 44 Imperial Building, Montreal, P. Q., Chief Engineer.

Findlay, Fort Wayne & Western.—A press dispatch states that work is progressing very satisfactorily on the extension from Glandorf, O., to Fort Wayne, Ind., 55 miles.

Baltimore & Ohio.—About one-half of the ballasting on the line from Akron to Chicago Junction, O., 73 miles, has been finished, and it is hoped to have the line in operation by June 15. Ryan & McDonald, of Baltimore, Md., were the contractors.

Killbuck Valley.—Work has been commenced on this line from Wooster to Lodi, O.

Projects and Surveys.

Elkhart & Western.—At a recent meeting of the officers and directors of this company the following officers were elected: H. G. Bucklen, Chicago, President; G. C. Bickel, Elkhart, Secretary and Manager; Stafford Mason, Auditor. The company will build a road from Elkhart to Mishawaka to connect with the Grand Trunk and has already acquired a portion of the right of way.

Cincinnati, Portsmouth & Virginia.—A railway company by this name has been chartered in Ohio.

SOUTHERN.—Existing Roads.

Roanoke & Southern.—Tracklaying has been commenced from Martinsville, Va., toward Roanoke.

Dayton & Faunsdale.—It is stated that the funds necessary to complete this line from Dayton to Faunsdale, Ala., 8½ miles, have been secured. R. W. Price, of Dayton, Ala., is President.

Abbeyville & Way Cross.—It is stated that the rails have arrived and that tracklaying will be begun soon from Bowen's mills south. The surveys for the northern extension of the road have been completed as far as Hawkinsville, Ga.

National Lookout Mountain Co.—This recently chartered company has purchased the broad gage railway up Lookout Mt., Lookout Inn and other properties, and is now engaged in making general improvements in the roadbed, rolling stock and general facilities. Mr. A. B. Fitch is the engineer in charge of the work. The officers are: President, Fred. E. Smith; Vice-President, C. W. Baldwin; Secretary and Treasurer, C. H. Brown, and General Manager, Jere Baxter.

Atlanta & Florida.—The project to extend this Georgia railway from Fort Valley to the Gulf coast is again being agitated.

Kentucky Midland.—It is stated that Mason, Hoge & Co. will soon begin work on the proposed extension from Paris, Ky., east. The road must be completed to the Bath County line by Jan. 1, 1892, in order to receive the $250,000 subscribed by that county.

Crawfish Springs & Round Mt.—This road is projected to run from Chickamagua, Ga., to Round Mt., a small elevation at the highest point of Lookout Mt., and thence along Lookout Mt. to Fort Payne, Ala., 53 miles. The section from Chickamauga to Round Mt., 18 miles, is under construction. The road is being built by the Crawfish Springs Land Co. to open up coal mines at Round Mt. It is expected to have the line finished by Oct. 1, 1891. J. T. Wilder is President, and John C. Henderson is General Manager.

Projects and Surveys.

Florida.—The Governor has signed the bills incorporating the Florida, Georgia & Western Ry. Co., the Arcadia, Gulf Coast & Lakeland R. R. Co., the Chipula & Chippewa Lake R. R. Co. and the Lakeland, Mohawk & & Tavares R. R. Co.

Statesville Air Line.—A meeting of the parties interested in this road will be held at Statesville, N. C., July 4, to consider plans for building the line. The road is projected to run from Spartanburg, N. C., to Danville, Va. C. A. Carlton, of Statesville, is Secretary.

Staunton & West Augusta.—Chief Engineer V. C. Vincent is making a preliminary survey for the proposed line of this road to connect with the West Virginia Central & Pittsburg.

Smithsonia, Danielsville & Carnesville.—This is the name of the company noted last week as organized to build a railway from Smithsonia to Danielsville, Ga.

Kanawha Valley.—Chartered in West Virginia to build a railway from Parkersburg, W. Va., up the Little Kanawha River to near Hackett's Valley post office, in Webster Co. Among the incorporators are J. H. Fischer and Edward McCreery, of Parkersburg.

NORTHWEST.—Existing Roads.

Chicago & Eastern Illinois.—Grading on the line from Tuscola to Shelbyville, Ill., 40 miles, has been completed from Tuscola to the Okaw River, and tracklaying will soon begin.

Pawnee.—An official of this road is reported as saying that the prospects were good for the early construction of the proposed extension from the St. Louis & Chicago Junction to Auburn, Ill., 6 miles.

Missouri Pacific.—Tracklaying has been completed on the cut-off between Union and Plattsmouth, Neb., and work is being pushed between Plattsmouth to Omaha.

Yankton, Norfolk & Southwestern.—The contract for grading the first section of this railway from Yankton S. Dak., has been let to Sam. Walsh, of Yankton.

Projects and Surveys

Northeastern Nebraska Improvement Co.—R. B. Daley, South Sioux City, Neb., Secretary, writes us as follows:

This road is projected to run from South Sioux City to Homer, Neb., about 15 miles. The route is along the Missouri River bottom and is very favorable. All surveys have been finished. The principal business of the road will be in stone, brick, fire clay and the general freight and passenger traffic. The company was chartered May 12, 1891. C. D. Smiley, of South Sioux City, Neb., is President.

Quincy, Keokuk & Chicago.—Construction will probably be commenced on this line from Quincy, Ill., to Fort Madison, Ia., in July. F. C. Horn, Exchange Building, Chicago, is Chief Engineer.

Sioux City & Northwestern.—This company has completed the surveys for its proposed line from Sioux City, Ia., northwest. The line as surveyed runs from Sioux City to Neobrara, Neb., and thence along the valley of the Ponca River to the State line, 168 miles.

SOUTHWEST.—Existing Roads.

Kansas City, Nevada & Fort Smith.—The contract for building 12 miles south from Amoret, Mo., the present southern terminus of this road, has been let to Smith & Bradbury, of Kansas City, Mo. The ties and rails are on the ground, and work will begin at once.

Little Rock & Memphis.—About 1,000 men and 300 teams are now scattered along the section of the Memphis, Little Rock & Pacific R. R. between Little Rock and Hot Springs, Ark., and construction will begin soon. The length of this section is 60 miles and the contract has been let for 20 miles each to Oliver Ferguson & Sons, York, Woods & Loman, and J. T. Hinckley.

Red River & Southwestern.—It is expected to have this road graded from Henrietta to Archer City, Tex., by June 15, and in operation one month later.

Projects and Surveys.

Consolidated Terminal R. R. Co.—This company has been chartered at Kansas City, Mo., to build a line of railway about 2 miles long. E. L. Martin, W. S. Taylor and others of Kansas City, Mo.

Van Sickle Center.—This company has been organized to build a railway from Roberts via Granville, to Paris, Tex. President, B. A. Van Sickle; Vice-President, J. W. Hawkins, and General Manager, W. B. Shamburger. General offices, Roberts, Tex.

Hearne & Brazos Valley.—It is stated that sufficient money has been raised to build this road from Hearne to Mumford, Tex., and that work will begin at once.

Avoyelles Construction Co.—J. S. Branch, of Evergreen, La., Secretary, writes as follows:

This company has completed the surveys for a line from the Texas & Pacific R. R. to Evergreen, La., 3 1-10 miles. The line will ultimately be extended to Moreauville, La., about 9 miles further. The route is through a very level country. John Ewell, of Evergreen, is President.

Southwestern Pacific.—Chartered in Arkansas to build a railway from Augusta, Ark., via Little Rock, to Hartford, Ark., on the Indian Territory line with a branch from Little Rock to Dallas, Ark.

OCKY MT. AND PACIFIC.—Existing Roads.

Los Angeles Terminal.—About 500 men are now at work on this line. It is projected to run from San Pedro, Cal., through Los Angeles, to Hueneme, Cal., with branches to Pasadena, Altadena and Long Beach Cal., a total length of about 140 miles. T. P. Burnet, Los Angeles, Cal., General Manager.

Projects and Surveys.

Puget Sound Southern.—Chartered in Washington to build a railway from some point on the branch of the Puget Sound, at or near the mouth of the Nesqually River, in Thurston Co., Wash., by some practical route, in a general easterly direction to the Cascade Mountains, across said mountains and to some point where connection can be had with railroads in Idaho, and to equip and furnish such branch roads as may hereafter be decided upon.

Columbia River & Eastern.—Chartered in Washington to construct a railway from some point on the Columbia River in Wahkiakum Co. by the most practicable and convenient route, in a general easterly direction to and across the Cascade Mountains and to some point on the eastern boundry of the state, where connections can be had with railroads in Idaho; also to construct a railway from some point on the Columbia River, in Wahkiakum Co., in a westerly direction to some other point on the Columbia River or the mouth thereof in the State of Washington.

FOREIGN.

Monterey & Mexican Gulf.—It is expected to have the extension to Tampico, Mex., completed by the end of June. Track has been laid to within 8 miles of Tampico, and work is being actively pushed. It is stated that the company will proceed at once with the proposed extension from Venadito north to Sierra Mojada.

Culiacan & Sierra.—It is stated that work has been begun on this railway in the State of Sinaloa, Mex. The road will penetrate a rich mineral region.

Guadalajara & Chamela.—Work is being pushed on this line from Guadalajara, Mex., to Chamilla Bay, on the Pacific coast. About 20 miles of the line, from Guadalajara west, have been built, and the surveys are now in progress for the remainder of the line.

Mexican Southern.—Tracklaying on this Mexican railway from Pueblo to Oaxaca has reached Tecomovaca, 225 kilos from Pueblo. The section from Pueblo to Tehuacan, 127 kilos, was opened for traffic Feb. 5, 1891, and the section from Tehuacan to Tecomovaca, 98 kilos, will be put in operation as soon as the ballasting and bridge-work is completed. Of the 140 kilos between Tecomovaca and Oaxaca about 100 kilos are under construction, 25 kilos being graded ready for the track. The contractor, Mr. Chas. Thornton, has the grading well in hand. There will be a large amount of heavy work on this section, comprising tunnels, galleries and a large amount of masonry. It is hoped to have the road completed to Oaxaca by Dec. 31, 1892.

Lower California.—It is announced that the contracts have been let for building this railway from San Diego, Cal., to San Quinton, Lower California, 162 miles. The surveys are completed and the plans are now before the Mexican Government for approval. As soon as this is obtained it is stated that construction will begin. The road is being built by English capital. A subsidy of $8,000 per mile is granted by the Mexican Government.

North Mexican Pacific.—Mr. J. Fewson Smith has been appointed Chief Engineer of this road. His address will probably be Deming, New Mexico. Grading is in progress on the 30-mile section from Palomas to Corraltos, Mex. Grading on the section from Deming, N. Mex., south to the International line was finished some time ago.

Mexico.—A press dispatch from the City of Mexico contains the following in regard to railway progress in this country:

Active work in building the Chamela Ry. will be begun by an English syndicate. The Mexican Ry. proposes to extend its line to Oaxaca. Tehuantepec Ry. is encountering serious difficulties through heavy rains and labor troubles. The National Ry. reports traffic increasing. The Interoceanic Ry., hence to Jolapa, is in excellent condition, and thence to Vera Cruz is being ballasted, and trains are now running regularly. The Cerdan Valley R. R. is working toward Coyoocan and will soon begin construction toward Guadaloupe. The action of Congress in adjourning without conceding to the President extraordinary powers to grant railroad concessions, as in previous years, is causing considerable talk, but in Government circles it is ascribed to the wish of the President to stop granting concessions, and it is said that henceforth all kinds of concessions will be more difficult to obtain.

CITY TRANSIT.

Electric Railways.—New lines or extensions are reported as probable in the following places: Waco, Tex., address B. Moore; Atlanta, Ga., address the Atlanta & Chattahoochee River Ry. Co.; Cincinnati, O., address the Newport Electric Street Ry. Co. and the Mt. Auburn Electric R. R. Co.; Niagara Falls, N. Y., address the Niagara River Street Ry. Co.; Bonham, Tex.; Chicago, Ill., address the South Chicago Street Ry. Co., and the Cicero & Proviso Electric R. R. Co.; Joplin, Mo., address the Joplin Electric Street Ry. & Motor Co.; Brightwood, Ind.

Bidd-ford, Me.—The directors of the Biddeford & Saco Horse Ry. Co. have voted to equip the road with electric motors and have called a meeting of the stockholders to indorse their action.

Albany, N. Y.—The State Railroad Commissioners have approved of the proposed change from horses to electricity on a portion of the Albany Street R. R.

Niagara Falls, N. Y.—The Niagara Falls & Suspension Bridge Street Ry. Co. has asked permission to build and operate a line around Goat Island and across Goat Island Bridge.

Ballston Spa, N. Y.—Surveyors are said to be locating a line to Rock City Falls.

Rutherfordton, N. C.—Frank Reynolds, President of the Thermal Belt Electric R. R., is engaged in buying right of way for the line. When completed it will run through Hickory Nut Gap to Asheville, a distance of 40 mile. The water power along the proposed route will be used to run the generators.

Columbus, Ga.—It is reported that the North Highland Electric Ry. Co. will begin work within a few months. Concerning the contract, which has not yet been let, address S. A. Carter.

Florence, Ala.—It is reported that the Florence dummy line will be operated electrically.

Mobile, Ala.—The General Council on June 5 granted the Mobile Street Ry. Co. a franchise to operate its lines by electricity.

Jeffersonville, Ind.—The Ohio Falls Street Ry Co. has applied for authority to use electricity as a motive power.

Marion, Ind.—It is said that the Marion Street Ry Co. will extend its lines and adopt electricity.

Mattoon, Ill.—An effort is being made to build a line to Charleston, 12 miles distant.

Jackson, Mich.—The property of the Jackson City Ry. Co. has been transferred to the Jackson Street Ry. Co., and all arrangements are said to be now completed for putting in an electric railway. About 3 miles of standard-gage line will probably be finished this year.

Detroit, Mich.—F. E. Brookman, F. Heide, Jr., D. McGuire and others propose building a line to Mt. Clemens, at an estimated expense of $200,000.

Denver, Colo.—A franchise for a line to Irondale has been applied for.

Paris, Tex.—The Paris Gas & Electric Light Co. are reported to want prices of electric railway equipment.

Pasadena, Cal.—The proposed line up Wilson's Peak is 12 miles long, and has an average grade of 7%. There will be but one tunnel on the railway, and the longest of the four or five bridges will be but 250 ft. The road will be narrow gage, laid with 50 lb. rails, and the sharpest curves have a radius of 90 ft. Prof. T. S. C. Low is interested in the undertaking.

Dummy Railways.—New lines or extensions are reported as probable in the following places: Waco, Tex., address the Waco Dummy Ry.; Sioux City, Ia., address Mr. Hankinson.

Blacksburg, Va.—A charter has been secured for a line to Christiansburg.

Waterloo, S. C.—A stock company is being organized to build a line to Cross Hill, 5 miles distant. J. T. Harris can give information.

Columbus, Ga.—It is reported that Allen, Curtis & Co., of Chattanooga, Tenn., are organizing a company to build a line of some length near this city.

Cable Railways.—***Baltimore, Md.***—A syndicate of Baltimore, Philadelphia and New York capitalists has been formed to purchase the Baltimore City Passenger Ry. If the railway changes owners, a part of the lines will be operated by cables. The price, it is said, will depend upon the estimated cost of making the changes in the method of operating.

Chattanooga, Tenn.—It is reported that the Chattanooga Electric Ry Co. will build an inclined cable railway up Lookout Mt.

New Companies.—Twin City Rapid Transit Co., Elizabeth, N. J.; capital stock, $20,000,000; incorporators, H. W. Cannon, George Bliss, G. S. Coe, of New York, and others. Citizens' Street R. R Co., Bloomington, Ill.; capital stock, $250,000; incorporators, J. S. Neville, F. M. Churchill, G. N. Stunniefield. Ashtabula (Ohio) Rapid Transit Co.; capital stock, $150,000. Battle Creek, (Mich.)

Electric Ry. Co.; capital stock, $100,000. Jefferson Ave. Ry. Co., Detroit, Mich.; capital stock, $100,000.

HIGHWAYS.

Pennsylvania.—A road from the McKeesport line to Wm. O'Bryon, of McKeesport. It will be a telford or macadam road, 2¼ miles long, and will cost $12,000 to the turnpike is projected by A. W. Wood, John Christy and $16,000. Taylor, Romine & Scott are the engineers. Proposals will be opened June 15.

Idaho.—An extension of the Mt. Idaho wagon road to connect with Boise City has been located. The Boise City Board of Trade is interested.

Washington.—King Co. wants a system of public roads. Chehalis Co. will raise $250,000 for roads and bridges.

California.—The South Grove Wagon Road Co., of Columbia, Tuolumne Co. has been organized by A. C. Nelson, Thomas Conlin, W. H. Hilton and J. B. Parmall. Capital stock, $5,000.

BRIDGES, TUNNELS AND CANALS.

Bridges.—*Niagara Co., N. Y.*—The wooden bridge in the Ferris district, Wilson township, will be replaced by an iron structure.

Clifton Forge, Va.—Arrangements are being made to construct an iron bridge across Jackson River at this place. Address, Alleghany Mining & Development Co., Clifton Forge.

Manchester, N. C.—Plans have been prepared for building a railway bridge at West Fourteenth St. The structure will cost about $10,000.

Lumpkin Co., Ala.—A bridge will be built over the Chistsetoe River at Joe Leather's ford. The structure may consist of one span 124 ft. long or two spans 62 ft. each. Address, F. W. Hill, Dahlonega, Ga.

Canals.—It is stated that the next Congress will probably be petitioned for an appropriation to construct a canal around the Colbert shoals, below Sheffield, Ala. It is proposed to have the canal 6 miles long, with two locks, 240 × 80 ft. each, at an estimated cost of $2,500,000. Joseph Nathan, of Sheffield, Ala., can give further information.

WATER-WORKS.

NEW ENGLAND.

Phillips, Me.—Mason Parker informs us that a water company has been chartered and organized and that the next step is to employ an engineer.

Pittsfield, Me.—Water-works and water power are under consideration.

Townshend, Vt.—H. B. Kenyon informs us that estimates for works to cost $2,500 have been made, but as only $700 of stock has been subscribed for, the matter is likely to be dropped.

Fairhaven, Mass.—It is reported that the Fairhaven Water-Works Co has organized.

Leominster, Mass.—Bids will be received until June 15 for constructing a dam and grubbing the basin for a reservoir. Cephas Derby, Chairman.

Webster, Mass.—A petition for authority to build more adequate works is before the Water Supply Committee of the Legislature, but is likely to go over till another session.

MIDDLE.

Callicoon, N. Y.—The *Echo* favors building water-works.

East Randolph, N. Y.—Reun & Chapman, Castile, informs us that that they have the contract for building works here, price, $14,000. The supply will be by gravity to and from a reservoir.

Penn Yan, N. Y.—Works are talked of, but early action does not seem probable. The present supply is for fire protection only.

Rochester, N. Y.—Bids will be received until June 15 for about 600 tons of 12 to 4-in. cast iron pipe and specials. Thomas J. Neville is clerk of the Executive Board.

Union, N. Y.—The people have voted for works, 72 to 2. Water will probably be pumped from springs to a reservoir, and 25 hydrants are proposed.

Warwick, N. Y.—Bids will be received by the Water Commissioners until June 20 for constructing a dam and reservoir. Caldwell & Garrison, Newburgh, are the engineers.

Red Lion, Pa.—A reservoir is projected.

Forty Fort, Pa.—A charter has been granted the Forty Fort Water Co., of Wilkesbarre; capital, $5,000; directors, L. D. Shoemaker, Abram Nesbitt, both of Wilkesbarre, and others.

Pittsburg, Pa.—Bids for a 75 HP. boiler will be received until June 17. E. M. Bigelow is chief of Department Public Works.

Frederick, Md.—It is reported that improvements to the works will be made with Young Bros., Philadelphia, contractors.

SOUTHERN.

Asheville, N. C.—The Asheville & Sulphur Springs Land Co. has been organized with J. D. Murphy as President and Henry Sheppard, Secretary. Water-works, sewers and electric lights are projected.

Macon, Ga.—It is reported that the city will ask the legislature for authority to build works.

Green Cove Springs, Fla.—It is reported that another company will apply for a franchise.

Bell City, Ala.—A company is projected.

NORTH CENTRAL.

Cambridge, O.—Proposals for constructing a 2,000,000-gall. direct-pumping and standpipe system will be ceived until July 15 by Mr. John S. Black, Village Clerk. Mr. O. M. Hoge is City Engineer.

Indianapolis, Ind.—It is reported that the city has authorized the company to extend its mains 14,800 ft.

Noblesville, Ind.—The works will be built by a local company, it is stated.

Holland, Mich.—Contracts for extensions aggregating $14,000 have been let. Pipe will be furnished by the Addyston Pipe & Steel Co., Cincinnati.

Ludington, Mich.—The Ludington Water Co.'s works are offered for sale by C. G. Wing, President. The system is direct pumping, with Holly pumps and 8 miles of mains.

Romeo, Mich.—A water-works committee has been appointed by the council. The proposed supply is from artesian wells. Estimated cost, $25,000. An election to vote bonds will probably be held.

Chicago, Ill.—The contract for the water-supply system for the Columbian Exposition has been awarded to Mac Kitchie & Nichol, of Chicago. The plans and specifications were prepared by W. S. Mac Harg, of Chicago.

Peru, Ill.—E. Sutphin, St. Louis, Mo., has received the contract for works, for $50,500. Gordon pumps and Chapman valves and hydrants will be used. Charles H. Ledlie, St. Louis, is consulting engineer and W. A. Calhoun, engineering agent for the city.

Pontiac, Ill.—William McKay, Mayor, informs us that bids for works to be owned by a company will be received until June 19 by the council. The supply will be pumped from springs to a stand-pipe. Estimated cost $50,000. Population, 3,000.

NORTHWESTERN.

Luverne, Minn.—Bids will be received until June 20 for material and labor for water-works, including driven wells, two 750,000-gall. pumps, two boilers, brick station 15 × 90 ft., standpipe, about 195 tons of cast-iron pipe and hydrants, valves and specials. Harrison & Hawley, Drake Block, St. Paul, are engineers and Albert Borck is Recorder.

Tracey, Minn.—The works for which bonds have been voted are estimated to cost $25,000.

Mason City, Neb.—Works have been completed and accepted by the village.

Oakland, Neb.—Bids for constructing works and for $7,500 of water bonds were received June 9. J. W. Holmquist is Village Clerk.

Dillon, Mont.—The following is from J. H. Lawrence:

Works are projected by the Dillon Water & Light Co., which has not yet organized, but proposes to let contracts within 30 days. It is proposed to pump water by two 1,000,000-gall. pumps from springs one mile distant to a 12 × 100 ft. stand-pipe. Estimated cost, $50,000. Population 1,500.

SOUTHWESTERN.

Comanche, Tex.—Works are wanted.

Sulphur Springs, Tex.—It is reported that a franchise has been granted to W. W. Marmaduke, Washington, Ind.

PACIFIC.

Seattle, Wash.—Superintendent Chalk has recommended the purchase of a 9,000,000-gall. compound condensing high-duty pump. A gravity supply is also talked of.

Union, Ore.—Bids are wanted until June 17 for constructing an influent crib and furnishing and laying 12,435 ft. of 10, 1,000 ft. of 8 and 500 ft. of 6 in. pipe. W. T. Wright is Mayor.

CANADA.

New Westminster, B. C.—Construction of works is in progress.

ARTESIAN WELLS.

Marion, S. C.—Bids for sinking a 6 or 8 in. artesian well are wanted by R. J. Blackwell, Chairman City Council.

Helena, Mont.—There is much talk about experimental artesian wells here.

Wichita Falls, Tex.—A well is wanted.

Bessemer, Col.—A well is under consideration.

IRRIGATION.

Dodge City, Kan.—The Western Kansas Water Works Irrigation & Land Co. has filed articles of incorporation; capital stock, $1,000,000; directors, W. M. Sutton, W. H. Pearce, J. W. Gilbert, G. G. Gilbert and E. E. Toule. The company proposes to lay out town sites, build dams, canals, water works and electric light plants.

Laramie, Wyo.—The Fort Sanders Ditch Co. has completed preliminary work for a ditch 13 miles long and 12 ft. wide at the bottom. It will convey water from Big Laramie to the old reservation south of the town. J. S. Richards is at the head of the enterprise.

Delano, Cal.—Pumps and tanks are being used for irrigating vineyards.

San Bernardino, Cal.—It is reported that the Arrowhead Reservoir Co. will carry on the construction of its irrigating works as rapidly as possible. The project includes three reservoirs and a canal or canals. James Gamble, of Cincinnati, O., is President.

Walnut Grove, Ariz.—It is reported that A. O. Brodie, Superintendent of the Walnut Grove Water Storage Co., recently stated that the construction of a new dam, to take the place of the one damaged by flood, will be started this fall.

Yuma, Ariz.—It is reported that work on the ditch of the Yuma Pumping & Irrigating Co. will be pushed to completion this year. E. M. Sanford, Prescott, Ariz., is General Manager. The Yuma Heights Irrigating Co. proposes to pump water from the Colorado River to irrigate land near Yuma. H. W. Blaisdell and L. A. Hicks, of Yuma, and S. M. Franklin, of Tucson, are the incorporators. The Algadones Irrigation Co. has been incorporated to operate in Yuma Co., by E. M. Sanford, Prescott, and others; capital stock, $2,000,000.

SEWERAGE AND MUNICIPAL.

Sewers.—*Maine.*—Gardiner. An engineer is to be engaged to lay out a system of sewers, and prepare plans and specifications.——Thomaston. Plans for a sewerage system are to be prepared by T. W. Baldwin, of Bangor.

Massachusetts.—Marlborough. The General Court has been petitioned to enact a law authorizing the city to raise $100,000 additional for the sewerage and sewage disposal.——Woburn. A bill has passed the State Senate authorizing the Mayor to appoint sewerage commissioners.——Brockton. Mr. A. F. Black, of Malden, has made a proposition to put in his system of sewage treatment, which is owned by the United States Sewage Filtering & Fertilizer Co.

Rhode Island.—Pawtucket. A bill has been passed authorizing the establishment of a sewerage system.

New York.—Brooklyn. Work is soon to be commenced on the sewers for the 26th Ward. The sewage will be carried to deodorizing tanks.——Rochester. The ordinance for the east side sewer, following the recommendations of Mr. Kuichling's report has been adopted. The sewer will be 42,772 ft. long, of varying size, and will cost about $1,000,000.

New Jersey.—Washington. The Sanitary Sewer Co., of New York, has applied for a franchise for sewers.——Plainfield. A franchise has been granted to J. M. Low, of Kingston, N. Y.

Pennsylvania.—Williamsport. An ordinance has been passed dividing the city into sewer districts, and adopting the system of house and storm water sewerage, designed by Mr. H. C. Reeder, City Engineer.——Carbondale. Work is to be pushed on the new sewers.—Corry. A report on the proposed sewerage system recommending brick sewers, has been made by Mr. R. H. Wilson, of Washington, Pa.

Delaware.—Wilmington. A new intercepting sewer on the south side is to be built at a cost of $21,600. Mr. T. C. Hatton is the engineer.

Virginia.—Salem. Contracts have been awarded for laying sewer pipe.

South Carolina.—Columbia. A company is to be organized to build a system of sewers. For particulars address the Mayor.

Kentucky.—Lexington. It has been proposed to build a main sewer on Vine St., and to abandon the Branch which would then be filled up.——Covington. An ordinance for a system of sewerage has been adopted.

Illinois.—Streator. Mr. Graves has prepared plans for a sewerage system.——Rogers Park. The contract for the new sewerage system has been awarded to Mr. F. C. Horn, Chicago.

Iowa.—Cedar Rapids. Bids for about 2 miles of 6 to 18 in. pipe sewers will be opened June 16.

Washington.—Seattle. Mr. Benezette Williams, of Chicago, has stated that his plans for the sewer system are well on toward completion.

Oklahoma Territory.—Oklahoma. Mr. Burns, city engineer, has prepared plans for a drainage ditch 8 ft. deep and 20 ft. wide at the top. It will be lined with plank, and will cost $5,000.

Canada.—Toronto Junction, Ont. The council has determined to construct the system of sewerage according to the plans prepared by Mr. Kuichling and Mr. Chipman.

Streets.—*Rhode Island.*—Providence. The Commissioner of Public Works has been directed to macadamise Broadway.

Connecticut.—Hartford. The Street Board is said to be in favor of asphalt paving.

Pennsylvania.—York. The Board of Trade has presented a petition to the council in favor of street improvement.

Georgia.—West End. A considerable amount of paving and curbing is in progress. Mr. P. N. Black, of Atlanta, is the engineer in charge of improvements.

Indiana.—Indianapolis. Brick paving is to be laid on Coburn St. The brick will be 2¼ × 4¼ × 8¼ ins.

Bonds.—Grand Forks, No. Dak.; $50,000 for sewers. Rock Hill, S. C.; $10,00 for streets. Brooklyn, N. Y.; $1,300,000 for bridge and park purposes. Montgomery, Ala.; $25,000 for streets. Omaha, Neb.; $50,000 for paving in South Omaha. Hurley, Wis.; $15,000 for sewers.

ELECTRICAL.

Electric Light.—New plants or extensions of existing systems are reported as probable in the following places: Ensenada, Cal., address S. Z. Salorio; Washington, Pa.,

address the Washington Electric Light & Power Co.; Georgetown, Tex., address J. Steele; Paris, Tex., address the Paris Gas & Electric Light Co.; Prescott, Ark.; Dupont, Ga., address A. Dupont; Ozark, Ala.; Hallettsville, Tex.; Newton, N. C., address G. McCorkle; Hamilton, O., address Chas. Cornell; Rosedale, Miss.; Asheville, N. C., address J. D. Murphy; Norfolk, Va., address the Merchants' & Miners' Transportation Co.; Greenville, Ala., address J. R. Porterfield; Portage, Wis., address I. W. York; Healdsburg, Cal.; Middleton, Conn.; Stoughton, Wis., address J. S. Hutson; Le Roy, N. Y.; Middletown, Conn.; Ticonderoga, N. Y., address E. W. Hyde; Alma, Wis.; Ashville, Ala., address J. A. Hodges.

Braintree, Mass.—A committee has been appointed to report on the advisability of lighting the town by electricity. T. A. Watson is a member.

Danvers, Mass.—The State Legislature has passed a bill permitting this town to establish an electric plant and to distribute light and power.

Cambridge, Mass.—The Board of Alderman has contracted with the Cambridge Electric Light Co. for not less than 400 arc lights, at $115 each per annum.

New Orleans, La.—Proposals for an incandescent lighting plant for the Marine Hospital will be received until June 16, by C. G. Johnson.

Wilmington, O.—It was voted on June 1 to establish municipal electric lighting plant.

Indianapolis, Ind.—Specifications for the municipal plant have been prepared by the Board of Public Works. They embrace all points connected with erecting and operating for 10 years a station having a capacity of 750 arc lights of 2,000 c. p. each.

Cheboygan, Mich.—Bids for lighting the city are wanted by the City Attorney.

Washburn, Wis.—Bids for erecting and operating a plant are wanted by the Town Clerk until June 20.

Denver, Colo.—The Denver-Highlands Electric Co. offers to furnish lights of 2,000 c. p. at $9.80 per month each, incandescent lamps of 20 c. p. for street lighting at $20 per annum each, and of 16 c. p. at 7 mills an hour each.

Hallettsville, Tex.—Bids for furnishing a plant of 300 incandescent lamps capacity are wanted by Mayor M. S. Townsend.

Austin, Tex.—Bids will be received until June 25 by Larmour & Watson for furnishing a plant for the Southwest Texas Insane Asylum, near San Antonio.

New Companies.—Riverview Electric Light & Power Co., Chicago, Ill.; capital stock, $250,000; incorporators, F. S. Moffatt, H. P. Caldwell, G. C. Short. Holliston (Mass.) Gas & Electric Co.; capital stock, $8,000; incorporators, M. F. Coughlin, C. J. Driscoll, A. L. Forbes. Ellwood (Ind.) Electric Light & Power Co.; capital stock, $10,000; directors, C. M. Greenlee, V. Q. Irwin, J. Loomis, C. A. Gates. Winters Electric Co., Chicago, Ill., capital stock, $10,000; incorporators, F. M. Winters, A. F. Raymer, A. H. Baldwin. Greenwich (N. Y.) Electric Light & Power Co.; capital stock, $15,000; incorporators, H. Gray, L. Thompson J. Brooks and others. Vallejo (Cal.) Electric Light & Power Co.; capital stock, $50,000; incorporators, J. Maguire, T. A. Thornton, S. Brown and others. Wagniere Electric & Mfg. Co., Los Angeles, Cal.; capital stock, $250,000; directors, A. Wagniere, L. A. Le Doux and others. Cotton Shoals Electric Light & Power Co., Graniteville, S. C.; capital stock, $10,000; directors, A. Ethridge, W. A. Edwards. Crescent Electric Light Co., Long Island City, N. Y.; capital stock, $25,000; trustees, G. Gray, of New York; E. P. Foster, of Long Island City; H. A. Fisher, Jr., of Brooklyn. East Providence Electric Lighting & Transportation Co., Providence, R. I.; capital stock, $100,000; address E. C. Dubois. Shenandoah (Ia.) Electric Light & Power Co.; capital stock, $15,000; W. M. Croan, President.

CONTRACTING.

Brick Paving.—*Rockford, Ill.*—Contracts have been awarded by Mr. D. C. Dunlap, City Engineer, A, North Main St., J. B. Smith & Co.; B, North Church St., Rockford Construction Co.; C, South Wyman St., Rockford Construction Co.

	A.		B.		C.	
	Quantities.	Price.	Quantities.	Price.	Quantities.	Price.
New curbstone	Lin. ft. 7,300	$ .67	Lin. ft. 7,000	$ .65	Lin. ft. 400	$ .75
Curbstone reset	1,900	.10	400	.16	20	.75
Curb walls	.....	.....	Per cu yd	3.50	200	3.50
Earth filling	Cu. yds. 200	.....	Cu. yds. 100	.....	Cu. yds. 1,000	.....
Excav. and load. on wagons	12,000	.15	11,000	.16	340	.18
Excav., load. and hauling, 1,200 ft.	12,000	.25	11,000	.25	340	.25
Difference for hauling 1,200 ft.	12,000	.10	11,000	.10	340	.07
Brick pavement complete	Sq. yds. 22,000	1.75	Sq. yds 18,000	1.37	Sq. yds. 2,600	1.78
Total	$46,581		$32,020		$5,716	

Street Work.—*Washington, D. C.*—The District Commissioners have awarded contracts as follows for work on suburban streets: Brightwood Ave.: M. F. Talty, grading, 18 cts. per cu. yd.; hauling earth, per 100 ft. over first 500 ft., ½ ct. per cu. yd.; setting curb, 25 cts. per lin. ft.; laying brick sidewalk, 20 cts. per sq. yd.; laying cobble gutter, 25 cts. per sq. yd.; laying gutter flag and cross flag, 6 and 9 cts. per sq. yd.; hauling cobble and flag, 15 cts. per sq. yd. per mile. Anacostia Road: J. Frawley; grading, 18¼ cts.; hauling earth, ½ ct.; stone masonry, $5.75 per cu. yd.; brick masonry, $8; concrete masonry, $3.80; laying gravel roadway, 11 cts.; laying cobble gutter, 25 cts.; hauling cobble and flag, 10 cts.; Linden St. M. F. Talty; grading, 18 cts.; hauling earth, ½ ct.; laying sidewalks, 20 cts.; laying macadam and gravel roadway, 95 cts. and 15 cts.; laying cobble gutter and cross flag, 25 and 9 cts. Naylor Road: H. Naylor, Jr.; grading, 18 cts.; laying macadam roadway, 90 cts. Illinois Ave.: A. Gleeson; grading, 17 cts.; hauling earth, beyond 500 ft., ¼ ct. per 100 ft. Fourth St.: T. H. Lyons; grading, 19 cts.; hauling earth, ½ ct. Sixteenth St.: A. Gleeson; grading, 16¾ cts.; hauling earth, ¼ ct.; setting curb, 10 cts.; laying gravel roadway, 12 cts.; laying sidewalk and gutter flag, 16 cts. and 3 cts.

Cement.—*Cincinnati, O.*—The following proposals have been received by Major D. W. Lockwood, U. S. Engineer Office, for 1,000 bbls. of hydraulic Portland and 6,000 bbls. American natural cement: J. B. Speed & Co., Louisville, Ky.; $4.10 and $1.25 per bbl. P. W. Fisher, New York, N. Y.; $2.68, $1.74.

Brick and Cement.—*Washington, D. C.*—The following proposals have been received by the District Commissioners: Angus Lamon, 9,000 invert blocks at 50 cts. per ft; 495,000 vitrified bricks, at $24 per 1,000 for the ½-in. taper, and $23.50 for the ¼-in.; S. M. Hamilton, 460,000 bricks, $21.75 per 1,000. Cement: W. F. Hewett, 25,000 bbls Acme natural cement, $1.10 per bbl.; J. T. & J. M. Waters, 25,000 of Round Top, $1.20; 1,200 of Hercules Portland cement, $2.87; Chas. C. McColgan & Co., 1,200 Stettin Anchor Portland cement, $3.20; S. M. Hamilton & Co. 1,200 Hemmoor Portland slow setting cement, $3.05; Germanic Portland, slow setting, $2.90; quick setting Burham Portland, $2.85; S. S. Daish & Son, 8,000 Antietam cement, $1.20; Halliday & Richardson, 1,200 Manichmer cement, $3.05; Jackson Jones Co., 1,200 Germanic' $2.74 per bbl.; J. E. McCracken, Cincinnati, O., $3.60 for Portland; Gray & Church, Frankfort, Ky., $1.94 for American; Buckeye Portland Cement Co., Bellefontaine, O., $3.50 for Portland.

Rip Rap.—*Washington, D. C.*—The following proposals for 4,500 cu. yds. have been received by Col. P. C. Hains, U. S. Engineer Office: Westham Granite Co., Richmond, Va., $2.97 per cu. yd.; C. G. Smith & Son, Washington, $3.25; Port Deposit Granite Co., Port Deposit, Md., $3.25; J. E. Spencer, Lapidum, Md., $3.45; John Satterlee, Kings Bridge, N. Y., $3.47; M. A. McGowan, Georgetown, D. C., $3.65.

Iron Beams.—*Washington, D. C.*—The contract for rolled iron beams for the Congressional Library has been awarded to the Phœnix Iron Co., of Philadelphia, Pa., at 3.15 cts. per lb. for plain beams, and 3.34 cts. per lb. for punched and connected beams.

Levees.—*New Orleans, La.*—The Orleans Levee Board has awarded contracts to Louis Louque at 17¼ cts. per cu. yd. for earth work, $33 50 for cypress revetment, and 27¾ cts. per ft. for sheet piling.

PROPOSALS OPEN.

Bridges.—*Boston, Mass.*—Stony Brook bridge at the Back Bay fens. The Park Commissioners, 53 State St. June 19.

Tonawanda, N. Y.—Iron bridge over the canal and creek at Delaware Ave. E. Hannan, Superintendent of Public Works, Albany, N. Y. June 23.

Sewers.—*Rockford, Ill.*—About 7,700 lin. ft. of 9.12 and 15 in. pipe; manholes, catch basins, etc. D. C. Dunlap, City Engineer. June 22.

Salem, Ore.—M. E. Goodell, Recorder. June 30.

Paving.—*Washington, D. C.*—Asphalt pavement, curbing, etc. The District Commissioners. June 24.

Highways.—*Galion, O.*—About 6 miles of roads. J. B. Weddell, engineer. June 22.

Dredging.—*Baltimore, Md.*—About 190,000 cu. yds. N. H. Hutton, Engineer of the Harbor Board. June 19.

Wall and Culvert.—*Boston, Mass.*—Retaining-wall and culvert. Park Commissioners, 53 State St. June 19.

Building.—*Norfolk, Va.*—Court house and jail. I. H. Harn, Clerk of Board of County Supervisors. July 27.

Docks.—*Velasco, Tex.*—G. W. Angle, Brazos River Channel & Dock Co.

Baton Rouge, La.—Wharves. Plans and specifications at the Mayor's office. E. Jolly. June 19.

Philadelphia, Pa.—Dry dock pier at League Island. N. H. Farquhar, Chief of Bureau of Yards and Docks, Washington, D. C. June 17.

MANUFACTURING AND TECHNICAL.

Locomotives.—A standard-gage light engine is wanted by W. M. Jones & Co., Hoffman, N. C. The New York, Lake Erie & Western will add 50 ten-wheel freight engines to its equipment.

Cars.—The Pullman Palace Car Co., of Chicago, Ill., has built 2 passenger cars and a combination baggage and smoking car for the "red line" Keystone express of the Pennsylvania road. It has also a contract for 34 passenger cars for the Baltimore & Ohio. The Crossen Car Co., of Coburg, Ont., is building passenger cars for the Canada Atlantic. The Jackson & Sharp Co., of Wilmington, Del., is building 10 cars for the Chicago & West Michigan. The Laconia Car Co., of Laconia, N. H., is building cars for the Quebec Central. The Buffalo Car Mfg. Co., of Buffalo, N. Y., is building box cars for the Adirondack & St. Lawrence. The Schneider Combination Car Co. has been organized at Chicago by J. G. Schneider, Frank Riedle and B. McDevitt; $200,000.

Car Window.—The De Kalb ventilating car window, opening from either side, so as to prevent draft and exclude cinders, is being brought out by the Martin Anti-Fire Car Heater Co., of Dunkirk, N. Y.

Railway Stations.—Plans for a station for the Michigan Central at Woodward Ave, Detroit, Mich., have been prepared by Mr. B. L. Gilbert, of New York.

Cements.—Wm. Green and H. J. Rogers have organized as William Green & Co., with offices in the Rookery Building, Chicago, to import and deal in English, Portland, Belgium, German, Louisville, and other cements.

The Remington Construction Co. has been organized by C. Remington and H. D. Haight for municipal and general contracting. John Brown is Superintendent of Construction. Office, Exchange Building, Chicago, Ill.

The King Iron Bridge & Manufacturing Co., of Cleveland, O., has been awarded the contract for the metal work of the Mines and Mining Building for the Columbian Exposition. The building will cover about 245,000 sq. ft., and the greatest height will be about 100 ft. The company also has the contract for a large steel drawbridge for the U.S. Government over the tidal canal at Oakland, Cal.

The Boughen Engineering Co., of Cincinnati, O., has moved to 179 Race St. It has contracts for machinery for the Cincinnati Inclined Plane Electric Ry. and the Brighton electric station of the Cincinnati Street Ry. It has completed pumping plants of 3,000,000 and 1,000,000 galls. capacity for the water-works at Huntington, Ind., and Harrison, O., and machinery for the electric light plant at the latter place.

The Lidgerwood Mfg. Co. is extending its works at South Brooklyn, N. Y.

The Berlin Iron Bridge Co., of East Berlin, Conn., has designed and is building a brick and iron machine shop for the Ball & Wood Co., of Elizabethport, N. J. The center part is 40 ft., with a wing on each side 20 ft. wide. The center part is served by an electric traveling crane.

Building.—Bids for an iron and brick building in Philadelphia, Pa., are being received by Constable Bros., architects, New York City.

Companies.—Consolidated Machine Brick Co., of Denver, Col.; J. Baker, J. A. Keefe and J. H. Boyle; $100,000. N. B. Pullman Co., of Chicago, Ill.; to manufacture railway appliances; C. E. Gaylord, C. N. White and M. J. Frost; $200,000. Seattle Bituminous Paving & Improvement Co., of Seattle, Wash.; F. Adams, G. C. Phinney and E. W. Gilmour; $50,000.

Metal Market Prices.—*Rails.*—New York: $30.75 to $31; old rails, $20.50 for iron and $17 for steel. Pittsburgh: $30; old rails, $23 to $23.50 for iron and $17.50 to $18 for steel. Chicago: $31; old rails, $22.75 for iron and $14.50 to $17 for steel.

Track Materials.—New York: steel angle bars, 1.7 to 1.75 cts.; spikes, $1.09 to $1.95; track bolts, 2.60 to 2.65 cts. with square, and 2.75 cts. with hexagon nuts. Pittsburg; splice bars, 1.8 to 1.9 cts. for iron or steel; iron or steel spikes, 2.05 cts.; iron track bolts, 2.75 cts. with square and 2.85 cts. with hexagon nuts. Chicago: splice bars, 1.85 to 1.9 cts. for iron, 2 to 2.05 for steel; spikes, 2 to 2.1 cts.; track bolts, 2.8 to 2.9 cts. with hexagon nuts.

Foundry Pig Iron.—New York: $14 to $18. Pittsburg: $14.75 to $17. Chicago: $14.50 to $16.

Pipe.—Cast iron, $25 to $30 per ton. Wrought iron, discounts as follows, at Pittsburg: 55 and 45 per cent. on black and galvanized butt-welded; 65 and 52½ on black and galvanized lap-welded. Casing, 55 per cent.

Lead.—New York: 4.45 to 4.5 cts. St. Louis: 4.15 cts.

Structural Material.—New York: beams, 3.1 cts.; channels, 3.1 cts.; angles, 1.95 to 2.1 cts.; tees, 2.45 to 2.75 cts.; sheared iron plates, 1.95 to 2.25 cts.; steel plates, 2 to 2.15 cts. for tank, 2.3 to 2.6 cts. for shell, 2.5 to 2.7 cts. for flange, 3.75 to 4.25 cts. for firebox. Pittsburg: beams, 3.1 cts.; channels, 3.1 cts.; angles, 2 cts.; tees, 2.6 cts.; universal iron mill plates, 2.1 cts.; sheared steel bridge plates, 2.1 to 2.15 cts.; refined bars, 1.8 to 1.9 cts.; steel plates, 2.1 cts. for tank, 2.45 cts. for shell, 2.7 cts. for flange, 3.9 to 4.25 cts. for firebox. Chicago: beams, 3.2 cts.; channels, 3.2 cts.; angles, 2.25 to 2.3 cts.; tees, 2.6 to 2.7 cts.; universal plates, 2.3 to 2.4 cts.; sheared plates, 2.5 to 2.6 cts. for iron and 2.6 to 2.7 cts. for steel; steel plates, 2.6 to 2.7 cts. for tank, 3.25 cts. for shell, 3.5 cts. for flange, 4.25 to 5.5 cts. for firebox; boiler rivets, 4 to 4.25 cts.

Commonwealth of Massachusetts

Metropolitan Sewerage Commissioners. Notice to contractors. Sealed bids for building Section 2 of the Metropolitan Sewerage System on Deer Island and Section 12 in Chelsea, in accordance with the form of contract and specifications to be furnished by the Board of Metropolitan Sewerage Commissioners, will be received by said board at its office, 93 Lincoln street, Boston, Mass., until 12 o'clock M. of SATURDAY, June 13, 1891.

No bid will be received unless accompanied by a certified check for the sum of $1,000.

All bids must be made upon the blank forms furnished by the board.

The external diameter of the sewer on these sections is approximately from 10 to 13 ft.

Some other particulars are approximately as follows:

Section.	Length, ft.	Average depth, ft.	Cu. yds., masonry.
2	2100	19	4800
12	3050	27	5500

Plans can be seen and specifications and form of con ract can be obtained at the above office.

Each bidder is required to make a statement indicating what sewer and similar work he has done, and to give references that will enable the board to judge of his business standing.

The board reserves the right to reject any and all bids.

HOSEA KINGMAN,
TILLY HAYNES,
ROBERT T. DAVIS,
} Board of Metropolitan Sewerage Commissioners of Massachusetts.

HOWARD A. CARSON, Chief Engineer.

21-4t

Niles, O., Water-Works.

Notice to Contractors.

SEALED PROPOSALS WILL BE RECEIVED by the Village Council of Niles, Trumbull County, Ohio, UNTIL NOON, JUNE 30TH, 1891, for furnishing material and constructing water-works for said village as follows:

One infiltration or supply basin, one building and one chimney, one storage reservoir, two pumping engines of 1,000,000 gallons each in 24 hours. Bids will be received for compound condensing and compound non-condensing machinery. Also two boilers for said works, including engine foundations, boiler setting, together with all pipes and fixtures complete.

Also the furnishing of 600 ft. of 14-in., 120 ft. of 12-in., 2 400 ft. of 10-in., 16,500 ft. of 8-in., 14,900 ft. of 6-in. and 12 750 ft. of 4-in. cast-iron coated water pipe, aggregating about 810 tons of 2,000 pounds. Also about 22 tons of special castings; also the laying of pipe and specials. Also the furnishing of 80 fire hydrants, 56 stop valves and 56 valve boxes, and setting same.

Bids will be received for the Water-Works System complete, or for any department of work, or material separately. The Council reserves the right to reject any or all bids. Plans and detailed drawings can be seen at the office of the Village Council on and after June 10. Specifications furnished contractors by the consulting engineer or the village clerk. Proposals must be indorsed "Water-Works Proposal."

J. B. STRAWN, Consulting Engineer,
273 Lincoln Ave., Salem, O.
M. J. FLAHERTY, Village Clerk,
Niles, O.

NILES, O., May 26, 1891. 22-5t

Sealed Proposals will be received at this office until July 6th, 1891, at 12 M., for the building of a sewerage system for the city of Vicksburg, Miss., as per plans and specifications now on file in the office of the City Clerk. The Board of Mayor and Aldermen reserve the right to reject any and all bids.

R. V. BOOTH, Mayor.

VICKSBURG, Miss., May 25th, 1891. 22-3t.

New Pumping Engines for Atlanta, Ga.

Sealed proposals will be received at the water-works office in the city of Atlanta, Ga., until 12 o'clock meridian, on the 8th day of July, 1891, for furnishing three horizontal high-duty compound pumping engines. Two of said engines to be located close to the Chattahoochee River, near the mouth of Peachtree Creek, and distant from the center of the city about seven miles. Each of these two engines to have the capacity to deliver 10,000,000 galls. in 24 hours against a pressure of 105 lbs. per sq. in. into a receiving reservoir. The other one engine to be located at a point between the river and city, and between three and four miles distant from the center of the city. This engine will be required to pump directly into the city water mains against a varying pressure of from 105 to 160 lbs. per sq. in., and to be so constructed that the pressure may be increased from the first to the second figure within two minutes from the time of receiving a fire alarm at the station.

Bids should be sealed and addressed to the Hon. Board of Water Commissioners, Atlanta, Ga.

Specifications may be had by addressing R. M. Clayton, City Engineer, or Wm. G. Richards, Superintendent, Atlanta, Ga.

The right is reserved to reject any or all bids.

HOWELL C. ERWIN, President.

ATLANTA, Ga., June 5, 1891. 24-4t

UTICA PIPE FOUNDRY CO.

CAST IRON PIPE AND SPECIALS FOR WATER AND GAS.

Also Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, etc.

CHAS. MILLAR & SON, Selling Agts., Utica, N. Y

Manufacturers of Lead Pipe and Plumbers' Materials.

Wholesale Eastern Agents Akron Vitrified Sewer Pipe.

MONTAGUE & CO.,
MANUFACTURERS
FIRE BRICK, SEWER PIPE,
DOUBLE STRENGTH
RAILROAD CULVERT PIPE,
With long sockets, in two and one-half foot lengths.
CHATTANOOGA, - - - TENN.

1871 IMPORTANT 1891
To Architects, Engineers and Contractors.

"SAYLOR'S AMERICAN PORTLAND CEMENT" has been on the American market for twenty years in successful competition to all Imported Portland Cements. Buyers will save money and secure the best results by using this brand. Sold in barrels and cotton or paper sacks.

JOHNSON & WILSON, GENERAL SELLING AGENTS,
Aldrich Court, 15 Broadway, New York.
Correspondence solicited. Note carefully the following letter:

A. J. Swift, Chief Engineer.
Albany & Susquehanna, Rensselaer & Saratoga, New York & Canada and Adirondack Railway. } Railroads.
Delaware & Hudson Canal Co.,
Office of the Chief Engineer,
Northern Railroad Department,
ALBANY, N. Y., Jan. 21, 1891.

MESSRS. JOHNSON & WILSON, ALDRICH COURT, NEW YORK.

GENTLEMEN: In answer to your inquiry as to the characteristics and merits of the "Saylor's American Portland Cement," which we have purchased from you during the last two years, I am glad to be able to say that it has proved entirely satisfactory, and, in my opinion, is as desirable for railroad engineering structures as any imported Portland cement which we have used, and this statement covers all the best known brands in use. We have had occasion, during the past three months, to remove abutments in which your cement was used, and therefore I am able to say, with a full knowledge of the facts, that the results have been eminently satisfactory. We have used it in the coldest weather during the past two years with a large percentage of salt, and have found it entirely satisfactory. It sets quickly, which is, of course, a matter of great importance where the traffic of the railroad has to be carried on green masonry, and its hydraulic properties have been thoroughly tested in coffer-dams where we have used it, and have proved to be excellent.

We propose to continue using it as our standard cement until something equally good and less expensive shall appear upon the market, and this we fail to find as yet.

It is, in my opinion, the cheapest high-class cement in use, and far superior in every desirable characteristic to all other brands of natural cements.

Yours very truly,
A. J. SWIFT, Chief Engineer.

[Copy]

NOTE.—The Delaware & Hudson Canal Co. have used six thousand (6,000) barrels of "Saylor's Portland Cement" to May 1, 1891. Put up in strong paper bags, saving 15 per cent. on the cost in barrels.

SPRINGFIELD, O., WATER-WORKS.

SEALED PROPOSALS will be received by the Trustees of Water-Works, Springfield, Ohio, at their office in the City Building, until eight o'clock P. M. of June 15, 1891, for furnishing approximately 200 tons of cast-iron pipe as follows:

20 tons of 3-inch, weighing 15 pounds per foot
20 " " 4 " " 22 " " "
65 " " 6 " " 33 " " "
15 " " 8 " " 42 " " "
75 " " 10 " " 60 " " "
5 " " special castings for same.

Delivery to commence within 10 days after signing of contract, and to be completed by October 1, 1891. The trustees reserve the right to alter the proportions required of the different sizes, as circumstances may dictate, the total tonnage remaining the same. All pipe and specials must have the usual coating, and all prices include the delivery "f. o. b." Springfield, Ohio.

The trustees reserve the right to reject any and all bids for any reasons.

(Signed) E. C. GWYN, C. NAGEL, } Water-Works Trustees.

SPRINGFIELD, O., May 30, 1891. 22-3t

Notice to Contractors.—Sealed proposals for the graduation, preparation of foundation and paving with brick a part of several of the streets of this city will be received by the Common Council of the City of Huntington, West Va., until 8 o'clock P. M., Monday, June 15, 1891, also until said time by the same will be received bids for furnishing curbing and setting the necessary curbstone for said improvements.

Complete specifications for each improvement can be seen on file at the office of G. H. Myers, City Clerk. The right is reserved to reject any and all proposals.

Proposals to be addressed to G. H. Myers, City Clerk, marked (paving or curbing) bids. Form of bids will be furnished by City Clerk.

C. A. BOXLEY,
Chairman Street Commissioners.
J. L. THORNBURG,
City Engineer.

22-3t

Port Clinton Short Line Railway.

SEALED PROPOSALS WILL BE RECEIVED at this company's office, in Port Clinton, Ottawa Co., O., until 11 A. M. on Monday, June 22, 1891, for supplying all rails, fastenings and ties for and laying 12 miles of standard track from Short Line Junction to Port Clinton. The work is to be completed within 90 days from June 22, 1891, and payment for all of same to be made in the company's first mortgage bonds at 90 cents on the dollar. All rights of way now secured, and grading, bridging and culverts done ready for track-laying.

The first mortgage will cover the entire 12 miles of property and valuable terminals, and the whole issue of bonds secured by same will be fixed at $100,000, bearing 6% interest.

Specifications and form of bid on application.

Right reserved to reject any and all proposals.

EDGAR H. BRENNAN,
President and Engineer.

PORT CLINTON, Ottawa Co., O.,
May 13, 1891. 21-5t

Proposals.

OFFICE WATER-WORKS,
SAVANNAH, GA., May 21, 1891.

SEALED proposals will be received by the City of Savannah, Georgia, until eleven (11) o'clock A. M., July 15th, 1891, for furnishing and constructing Two (2) High-Duty Pumping Engines, each having a capacity of Ten Million (10,000,000) U. S. gallons per day, and the necessary Boilers and other appurtenances pertaining to a pumping plant. All to be in accordance with general specifications on file in the Water Office at Savannah, Ga., or which, with all other information, can be obtained from Thomas T. Johnston, Consulting Engineer, at room No. 29, No. 171 La Salle street, Chicago, Illinois.

Proposals must be made in accordance with the aforesaid general specifications. No proposal will be considered unless the party offering it can furnish evidence satisfactory to the Mayor and Board of Aldermen of the City of Savannah of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and the specifications, provided such contract should be awarded h'm.

The right to reject any and all proposals not deemed for the best interest of the city is reserved.

JAMES MANNING,
Superintendent.

22-4t

For Constructing Reservoir.

Sealed proposals will be received by the undersigned Water Commissioners of the Village of Warwick, Orange County, N. Y., until noon of the 20th day of June, 1891, at the office of F. V. Sanford in Warwick, for constructing a dam and reservoir, as an extension of the water system of said village, and to furnish an additional supply of water, according to the plans and specifications, which may be examined at the office of said F. V. Sanford at any time between the hours of 9 a. m. and 4 p. m.

Bonds (to be approved by said Commissioners) will be required for the full and faithful performance of the contract.

The right is reserved to reject any and all bids.

Bids will be opened at the place above mentioned on said 20th day of June at 2 p. m.

Dated Warwick, N. Y., June 3, 1891.

W. A. HULSE,
GRINNELL BURT,
JAMES H. HOLLY,
F. V. SANFORD,
Water Commissioners.

CALDWELL & GARRISON,
Civil Engineers,
Newburgh, N. Y. 24-1t

Notice to Bridge Builders.

Sealed proposals, marked "Proposals for St. Martin Bridge," will be received by the County Commissioners of Stearns County, Minnesota, at the Office of the County Auditor, St. Cloud, Minn., up to Monday, July 13, 1891, at 3 o'clock P. M., for building and erecting complete an iron highway bridge of one hundred and sixty (160) feet span, across Sauk River, in the town of St. Martin.

Plans can be seen and specifications obtained from the County Auditor or Engineer. Bids will be received for substruction and superstruction separately or both together. A certified check for two hundred ($200) dollars, payable to the order of the County Treasurer must accompany each bid as a guarantee that, if awarded the work, a satisfactory bond for one-fifth the amount of the bid will be given and contract entered into within five days from date of award. The right is reserved to accept that bid which is for the best interest of the county whether the lowest or not, and to reject all bids if desired.

PAGE & SMITH,
Engineers, St. Cloud, Minn.

Dated at St. Cloud this 6th day of June, 1891.

BARTH. PIRZ,
EDWARD MILLER,
JOSEPH SCHEELAR,
Committee.

24-3t

Menominee Mich., Sewers.

Sealed proposals will be received by the City Clerk of the city of Menominee, Michigan, until 12 o'clock noon, Monday, June 22, 1891, for furnishing material and building in the aggregate nine (9) miles of pipe sewer ranging in size from 8 inches to 36 inches in diameter. Plans of the above work may be seen, and specifications, blank forms of proposal, and bonds may be obtained of said City Clerk, or the Engineer, where any other desired information may be obtained.

The proposals must be sealed, and indorsed "Proposal for Construction of Sewers," and addressed to the City Clerk of the city of Menominee, Michigan.

No proposal will be entertained unless accompanied by a certified check for the sum of $1,000.

The City Council of the city of Menominee, Michigan, reserves the right to reject any or all bids.

O. BURLINGAME, Engineer. J. E. SOULTS, City Clerk.

Dated, Menominee, Mich., June 2, 1891. 21-1t

Cambridge, O., Water-Works.

Sealed proposals will be received by the Village Clerk of the Village of Cambridge, Guernsey Co., O., until 7½ o'clock P. M., July 15, 1891, for a first-class system of water-works, said works to be operated on the rental plan.

The works shall be a combination of the direct pumping and stand-pipe system, so called, and capable of being operated by either.

The capacity of said works not to be less than 2,000,000 U. S. gallons per day.

For further particulars as to specifications, etc., inquire of Village Clerk.

The Village Council reserves the right to reject any or all bids.

JNO. S. BLACK,
Village Clerk.
O. M. HOGE,
City Engineer.

CAMBRIDGE, O., June 6, 1891. 24-2t

[For other Proposals see following page.

Notice to Contractors.

LACONIA, N. H.—SEWERAGE.

Sealed proposals will be received until noon of Tuesday, June 23, 1891, by the Sewer Committee of Laconia, N. H., for the construction of sewers and subsoil drains in the village of Laconia, consisting, approximately, of

4,410	lineal ft.	of twelve (12)-in.	vitrified	sewer
4,790	"	ten (10)-in.	"	"
8,110	"	eight (8)-in.	"	"
39,127	"	six (6)-in.	"	"
460	"	ten (10)-in.	cast-iron	pipe.
300	"	twelve (12)-in.	"	"

52 flush tanks.
1 large tank.
20 manholes.
150 inspection or lampholes. Together with the necessary bends, branch connections, stoppers, etc.

Proposals must be made on blank forms furnished by the Committee, and all legal formalities must be complied with to secure consideration of proposals.

Plans, profiles and details for the above work can be examined and specifications and blank forms obtained at the office of the Town Clerk, Laconia, N. H., or of the Engineers, Waring, Chapman & Farquhar, Newport, R. I.

Proposals must be sealed and addressed to the Committee, and be indorsed "Proposals for Sewers," and with the name of the person, firm or corporation which makes the tender, and be accompanied by a certified check for $1,000, payable to the order of the Town Treasurer.

The Committee reserve the right to reject any or all proposals.

SAMUEL B. SMITH,
ALMON J. FARRER,
FOREST G. BERRY,
ALBURTUS S. GORDON,
NAT. J. EDGERLY,
Sewer Committee.

WARING, CHAPMAN & FARQUHAR,
Engineers. Newport, R. I. 24-2t

Rockford, Ill., Sewerage.

SEALED PROPOSALS will be received in pursuance of a certain ordinance passed on the first day of June, 1891, at the office of the City Clerk until 3 p.m. on the 22d day of June, 1891, for furnishing material and labor and constructing a public sewer on certain portions of Seminary, South Third, Catlin, East Seminary, Kishwaukee and Gregory streets, with lateral branches on Catlin and Union streets, total length about 7,700 lineal ft.

Approximate quantities as follows:

2,102 lineal ft. of 9-in. pipe.
2,784 lineal ft. of 12-in. pipe.
2,466 lineal ft. of 15-in. pipe.
110 lineal ft. of 6-in. Ys. on 9-in. pipe.
126 lineal ft. of 6-in. Ys. on 12-in. pipe.
112 lineal ft. of 6-in. Ys. on 15-in. pipe.
11 manholes 4 ft. in diameter at base.
5 manholes 5 ft. in diameter at base.
31 catch basins (more or less).

Said work must be done in substantial compliance with the terms of said ordinance and the specifications for such improvements. Plans and specifications may be seen at the office of the City Engineer. Proposals must be accompanied with samples of pipe and brick to be used, and a certified check on some responsible bank for $500, and payable to the order of the city of Rockford.

Estimates will be issued monthly and will bear interest at the rate of 6 per cent. per annum until paid, about April 1, 1892.

The city reserves the right to reject any or all bids, or not to accept the lowest bid.

Companies or firms bidding will give the individual names as well as the names of the firm, with their addresses.

F. G. HOGLAND, City Clerk.
D. C. DUNLAP,
City Engineer and Supt. of Sewers.

ROCKFORD, June 5, 1891. 24-1t

STONE AND DREDGING AT FLUSHING Bay, N. Y.—Engineer Office, U. S. Army, Room H 7, Army Building, 39 Whitehall Street, New York, N. Y., May 23, 1891.—Sealed proposals, in triplicate, for stone and dredging at Flushing Bay, N. Y., will be received at this office until twelve (12) o'clock noon on Monday, June 22, 1891. The attention of bidders is invited to the Acts of Congress approved Feb. 26, 1885, and Feb. 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Further information can be obtained at this office. Applications should be indorsed on the envelope "Official Business." D. C. HOUSTON, Colonel of Engineers. 21-4t

U. S. ENGINEER OFFICE, ARMY BUILDing, New York, May 23, 1891. Sealed proposals, in triplicate, will be received at this office until 12 o'clock noon, June 24, 1891, for the construction and delivery of one iron roof truss for torpedo shed at Sandy Hook, N. J. The attention of bidders is invited to acts of Congress approved Feb. 26, 1885, and Feb. 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes-at-Large. For specifications, blank forms, and all information, apply to the undersigned, G. L. GILLESPIE, Lieut.-Col. of Engineers. 23-3t

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Sewer Construction.

MANITOWOC, WISCONSIN.

Sealed proposals for the building of sewers and appurtenances will be received until 8 o'clock P. M. June 17, 1891, at the office of the Board of Public Works of Manitowoc, Wisconsin.

The work comprises the furnishing, laying and building the main and intercepting sewers, outfalls, manholes, flush tanks, etc., in the city of Manitowoc, Wisconsin, according to plans and specifications on file in the office of the Board of Public Works.

The sewers are to be all of vitrified pipe and the approximate quantities required are:

820	lineal feet	24-inch	sewer	pipe.	
2,320	"	20	"	"	"
3,160	"	15	"	"	"
1,390	"	12	"	"	"
7,290	"	10	"	"	"
6,420	"	8	"	"	"

47 manholes; 4 flush tanks; 2 timber outfalls.

Iron work for manholes and flush tanks are to be of approved design and manufacture, and bidders are requested to submit designs of the same, giving weight and prices.

Each proposal must be signed with the full name of all persons interested therein, and must contain $500 in cash or a certified check good for that amount, which will be returned to the unsuccessful bidder when the contract is awarded. The successful bidder to give an approved bond of $10,000 for the faithful performance of the work.

All proposals to be made upon the official blank form, which can be obtained from the City Clerk upon application.

Proposals must be addressed:

Proposals for sewer construction, Board of Public Works, Manitowoc, Wisconsin.

The right is reserved to reject any and all bids.

By order of the Board of Public Works.

ARTHUR REICHNRT, Clerk,
June 3, 1891. Manitowoc, Wis.
W. F. GOODHUE, Consulting Engineer,
24-1t Milwaukee, Wis,

OFFICE OF U. S. LIGHT-HOUSE ENgineer, Fourth District, Room 20, fourth floor, P. O. Building, Philadelphia, Pa., June 6, 1891. Sealed proposals will be received at this office until 12 o'clock, M. of Monday, the 15th of June, 1891, for furnishing the materials and labor of all kinds necessary for building jetties of brush and stone at Absecon Light Station, New Jersey. Total length of jetties about 500 ft. Specifications, forms of proposals and other information may be obtained on application to this office, where maps of the locality may be seen. The right is reserved to reject any or all bids, and to waive any defects. F. A. MAHAN, Captain of Engineers, U. S. A., Engineer 4th L. H. District. 24-1t.

Notice to Sewer Contractors.

WILMINGTON, DELAWARE.

SEALED PROPOSALS for the construction of approximately 6,400 feet of stone and brick sewers and 1,800 feet of pipe sewers and appurtenances will be received at the office of "The Board of Directors of the Street and Sewer Department" up to 7:30 o'clock p m, June 30, 1891. Plans can be seen at the office of the engineer in charge of sewers, and forms of proposal, contract and specifications will be sent to those desiring them. All bids must be made upon the blank form furnished by the engineer. A certified check for $500 will be required to accompany each proposal and a bond for not less than one-third of his total bid will be required of the successful bidder. The Board reserves the right to increase or diminish the quantities bid for or to reject any or all bids. The internal diameters of the sewers run from 2 feet 9 inches to 9 feet, and some other particulars are approximately as follows:

Length.	Cu. yds. excavation.	Cu. yds. brick masonry.	Cu. yds. stone masonry.
3,325 feet	4,956	875	
1,935 "	2,930	466	
336 "	266	190	565
196 "	520	85	435
540 "	2,700	200	1,970
1,729 "	1,569	18" to 8" pipe.	

T. CHALKLEY HATTON,
Engineer in Charge of Sewers.
Dated June 10, 1891. 24-3t

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